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AGRICULTURAL RESEARCH
IN INDIA

INSTITUTES AND ORGANISATIONS

By

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FOREWORD

There are a number of research institutes functioning under the Central Ministry of Agriculture, the Commodity Committees and the State Governments, in which research on agricultural, veterinary and animal husbandry problems is carried on. The need for an integrated account of research organisations and institutes in the country has been felt for a long time by administrators, legislators and others interested in agriculture. I am, therefore, glad that Dr. M.S. Randhawa, Vice-President of the Indian Council of Agricultural Research, has provided an integrated account of research institutions and their organisation and activities. In this task, he has received the assistance of the Directors of Central and Commodity Research Institutes, the Secretaries of the Commodity Committees and the Directors of the State Departments of Agriculture. For the first time, information about the results of various research schemes and the scope and functions of research institutes, which was scattered in various reports and publications of the Indian Council of Agricultural Research and the Commodity Committees and was available only to a few persons, has been compiled in a handy form. The book has been illustrated with interesting photographs. A number of maps have been added which show the distribution of research institutes and experimental farms and stations in various States of India.

I am sure, this publication, *Agricultural Research in India — Institutes and Organisations*, will be of great help to administrators and research workers as well as to public men who are interested in agriculture.

P.N. Thapar
Secretary
Department of Agriculture,
Ministry of Food and Agriculture

New Delhi,
The 1st March, 1958

INTRODUCTION

INDIA is primarily an agricultural country, and nearly three-fourths of its population depends directly on agriculture for a living. Therefore, agricultural development is intimately connected with the joy and happiness of the people in this country. The improvement of agriculture derives fundamentally from the work which is being silently carried on by an army of research workers in the various research institutes and stations. There are a number of such organisations and institutions in this country. It is, therefore, necessary that a connected account of the set-up, functions, and other details of such institutions and organisations should be readily available for consultation and reference. It is with this object that this book has been compiled.

Prior to 1903, there was no definite governmental policy for improvement of agriculture in this country. It is true that Famine Commissions were appointed in 1880, 1898, and 1901, and an Irrigation Commission was set up in 1903, who in their reports made some useful recommendations for the improvement of agriculture and for the promotion of welfare and prosperity of rural population. But the Famine Commissions, as the name implies, were naturally concerned primarily with the steps necessary to ameliorate the severity of famines, and the question of agricultural improvement was made subsidiary to the main problem. For example, the Famine Commission of 1880 recommended *inter alia* that improved agriculture should be the main step for obtaining security against disastrous failures in food supply.

The beginning of the 20th century was marked by awakening of interest in scientific study of agriculture throughout the world which had its repercussions in India as well. A forward policy in matters relating to agricultural research and improvement was embarked on by the Government of Lord Curzon. To this foresighted policy may be traced many of the steps taken subsequently for the advancement of Indian agriculture. It was realised for the first time that the establishment of agricultural research institutes and experimental farms and agricultural colleges was the first step necessary to bring about any progress in agricultural practices. It was at this time that a generous donation of thirty thousand pounds by Mr. Henry Phipps, an American philanthropist, was made available for establishment of a research institute with a fully equipped laboratory, and an experimental farm for training students, and a cattle-farm. This institution, which was called the Imperial (now Indian) Agricultural Research Institute, was established at Pusa in Bihar in 1905. It was transferred to New Delhi in 1936 after the disastrous earthquake of 1935.

At the time of the establishment of the Institute, it was visualised that it would be the apex of a research organisation with ramifications extending into the provinces. Therefore, it was decided to establish agricultural colleges equipped with expert staff for research as well as for instruction, in all the provinces. In pursuance of this policy, colleges were started or reorganised at Poona, Kanpur, Nagpur, Lyallpur, Coimbatore and Sabour.

Veterinary research had received prior attention. A central institute for veterinary research was established as early as 1889 in Poona, and subsequently shifted to Mukteswar in 1893; it was known as the Indian Veterinary Research Institute. This institution has been the pioneer in the field of veterinary research in this country.

As a result of the constitutional changes of 1919, agriculture became a transferred subject, i.e. a subject under the direct control of the provincial governments. The Government of India, therefore, divested itself, except for very limited objectives, of all powers of direction and control of agricultural and veterinary subjects, including research, teaching and policy making. There was thus no agency with specific purpose of co-ordinating work on agriculture and animal husbandry in different provinces and bringing them in line with the policy of the Central Government. It was, however, felt in course of time that the promotion and co-ordination of agricultural work should be brought about in a more effective manner than was possible with the help of the agricultural advisers to the Government of India, or through conferences of Ministers and Directors of Agriculture. It was also felt that it was essential for the advancement of agricultural research in India that the Central Institute of Agriculture established at Pusa should be brought into closer touch with the provincial departments of agriculture.

In 1928, a Royal Commission appointed to enquire into the conditions of agriculture and rural economy in this country, proposed the establishment of a Central Council of Agricultural Research with the primary function of promoting, guiding, and co-ordinating agricultural research throughout India. The aims and objects of the Council were to be as follows:

(*a*) To undertake, aid, promote and co-ordinate agricultural and animal husbandry research and education;

(*b*) To act as a clearing house of information not only in regard to research but also to agricultural and veterinary matters generally;

(*c*) To establish and maintain a research and reference library in pursuance of the objects of the Council with reading and writing rooms and to furnish the same with books, reviews, magazines, newspapers and other publications; and

(*d*) To do all other things which the Council may consider necessary, incidental or conducive to the attainment of its objects.

In pursuance of this recommendation, the Imperial (now Indian) Council of Agricultural Research was set up in 1929 as a statutory body by an Act of the Central Legislature.

The Council has developed into a premier organisation which guides, finances and co-ordinates research problems connected with agriculture and animal husbandry in the widest sense of the term. Its activities are not limited only to research projects, but also include such subjects as agricultural education and extension. It also undertakes training of students in agriculture and animal husbandry statistics, and has helped to build up a school of research in this field. In addition, it has set up two councils—one on agricultural and another on animal husbandry education. The other function in which it has taken a lead is the dissemination of results of research.

Apart from the Indian Council of Agricultural Research, there are a number of Commodity Committees which deal with research in respect of particular crops. These Commodity Committees are semi-autonomous bodies financed by grants from the Government of India, or by income from cesses, and are located in the main growing regions of the crops concerned. The earliest commodity committee to be organised is the Indian Central Cotton Committee which was established in 1921 and is located at Bombay. This Committee has provided great stimulus to research on cotton, and a number of improved varieties of cotton have been evolved in different States with the aid of funds provided by it. The advantages of commodity approach to research were clearly seen. It enabled the research workers and agricultural administrators to concentrate on problems of a particular crop whether these related to plant breeding, physiology, agronomy, plant protection, economics or technology. Realising the benefits of commodity approach to research, commodity committees were organised in respect of a number of other commodities. Thus the Indian Lac Cess Committee was established in 1931, the Indian Central Jute Committee in 1936, the Indian Central Sugarcane Committee in 1941, the Indian Central Tobacco Committee and the Indian Central Coconut Committee in 1945, the Indian Central Oilseeds Committee in 1947, and the Indian Central Arecanut Committee in 1949. The Indian Council of Agricultural Research may be likened to a mother polyp from which daughter polyps are budded, attain maturity, and develop into full organisms which ultimately lead an independent existence. With the exception of the Indian Central Oilseeds Committee, all other commodity committees have their own research institutes. With the organisation of a series of commodity committees, the field of the Indian Council of Agricultural Research came to be limited to food crops such as wheat, rice, barley, maize, millets and pulses, tuber crops, grasses and fodder crops, spices, horticulture and problems common to various commodities such as control of plant diseases and pests, manurial trials, improved implements and dry farming in the field of agriculture, and investigation and control of animal diseases, animal nutrition, animal breeding and dairying in the field of animal husbandry.

There was one disadvantage felt in the commodity approach to agricultural research. It lay in the fact that there was lack of co-ordination, and that sufficient emphasis was not given to problems of common interest to the various crops. The Vice-President of the Indian Council of Agricultural Research who is also the President of all the Commodity Committees was the sole co-ordinating link. However, this defect has now been largely overcome by bringing together all the Directors of the Research Institutes of Commodity Committees, and the Secretaries of the Committees on the Board of Research and Extension of the Indian Council of Agricultural Research, where problems of common interest in the field of research and administration are discussed. A major measure of co-ordination in the field of research is the organisation of "Regional Co-ordinated Research Stations for Cotton, Oilseeds and Millets." The scheme for co-ordinated regional research stations for cotton and its rotation crops, viz. oilseeds and millets, is an important development in the organisation of agricultural research in the country. The necessity of organising agricultural research on a cross-commodity basis was felt for a long time, and it is gratifying that a step in this direction has been taken. It is also a matter of great consequence that an organisation of a permanent nature has been created for tackling agricultural problems on a regional basis, which will ensure maximum efficiency coupled with economy in expenditure. In these research stations, research on interrelated agricultural problems of various commodities would be carried on by a band of scientists working as a team. The establishment of these composite regional stations would also provide a coverage for fundamental research applicable to a wide range of agro-climatic conditions. Co-ordination would also be provided between the work of the proposed composite stations and the State research stations dealing with these commodities through a committee headed by the Agricultural Commissioner with the Government of India, and having the Directors of Agriculture of States, the chiefs of regional stations concerned, the Director, Indian Agricultural Research Institute, the botanists dealing with cotton, oilseeds and millets of the States constituting the region, and the Secretaries of the Indian Central Cotton and Oilseeds Committees as members. This Committee would meet annually at a suitable place in the region and consider the programme of research drawn by the chief of the regional station. The chief of the regional station will also provide guidance to the State research stations located in the region and thus act as project leader.

A great deal of ignorance prevails regarding the organisations and institutions which deal with agricultural research in the country. This ignorance is also prevalent among the administrators who deal with agriculture in the States. Excepting the specialists who deal with the research organisations, very little is known to outsiders about the organisation of agricultural research and the various research institutes which are functioning under the Central Ministry of Agriculture, the Commodity Committees and the States. It is with a view to making the people aware of the work which is being done in the research institutes and stations, and the organisations which maintain them that this publication has been compiled. It is for the first time that an integrated account of research organisations and institutes in the country has been provided. The text is illustrated with photographs of the Research Institutes and Stations, a number of which were taken by Mr. H. K. Gorkha, Photographer of the Indian Council of Agricultural Research. A number of significant maps have been provided by Mr. N.S. Bisht, Director of Arts, Indian Council of Agricultural Research. I am grateful to Mr. J.V.A. Nehemiah, Secretary, Indian Council of Agricultural Research, for providing material relating to Indian Council of Agricultural Research. I am also grateful to Dr. B. P. Pal, Director, Indian Agricultural Research Institute, Dr. Pushkar Nath, Director, Central Potato Research Institute, Mr. R.L.M. Ghose, Director, Central Rice Research Institute, and Dr. Laxmi Sahai, Director, Indian Veterinary Research Institute, for providing information in respect of their respective institutes. I am also grateful to Dr. V.G. Panse, our Statistical Adviser for providing material relating to the Statistical Wing of Indian Council of Agricultural Research. I am also grateful to Dr. B. L. Sethi, Secretary, Indian Central Cotton Committee, Dr. R. Sankaran, Secretary, Indian Central Oilseeds Committee, Dr. P.K.J. Gregory, Secretary, Indian Central Coconut Committee, Dr. M.S. Patel, Secretary, Indian Central Tobacco Committee, Pandit K.N. Agha, Secretary, Indian Central Jute Committee, Sardar Pritam Singh, Secretary, Indian Central Lac Cess Committee, Shri P. P. Chandra, Secretary, Indian Central Sugarcane Committee, and Shri B.S. Varadarajan, Secretary, Indian Central Arecanut Committee, for providing information regarding organisation of their respective Commodity Committees and Research Institutes. I am further grateful to the Directors of Agriculture of all the States for providing information about their research stations in their respective States. Mr. Peshori Lal Malhotra compiled the information relating to research schemes financed by the Indian Council of Agricultural Research. I hope this information would prove very useful as reference material, and also for future planning of research. I am particularly grateful to Dr. U. N. Chatterji, Editor, Indian Council of Agricultural Research, for editing the material. It is hoped that this publication will be of interest to people who are connected with the administration of agriculture and animal husbandry research in India, as well as to those who are interested in agriculture and animal husbandry.

M.S. RANDHAWA
Vice-President,
Indian Council of Agricultural Research

New Delhi,
Dated the 1st March, 1958

INDIAN COUNCIL
OF
AGRICULTURAL RESEARCH

Indian Council of Agricultural Research

INDIAN COUNCIL OF AGRICULTURAL RESEARCH

New Delhi

THE administration and co-ordination of agricultural work and governmental policy relating to it were looked after by the Government of India till 1921. As a result of the Montague-Chelmsford Reforms in 1921, agriculture became a transferred subject under the administration of the provincial governments. It was, however, felt necessary that there should be a central agency which could co-ordinate the agricultural activities in the country. In order, therefore, to explore the conditions relating to agriculture and rural economy in this country, a Royal Commission was appointed in 1928. The Commission recommended the setting up of a central council entrusted with the task of co-ordinating agricultural research throughout the country. In accordance with this recommendation, the Indian (then Imperial) Council of Agricultural Research was set up in 1929 to promote, guide and co-ordinate agriculture and animal husbandry research throughout India. This council was also entrusted with the task of functioning as a link with agricultural institutions in India and those in foreign countries. The Council is a non-governmental society registered as a body incorporated under the Registration of Societies Act, 1860 (Act XXI).

The Council functions as an important forum for discussing agricultural research and general agricultural policies of the country as a whole and also serves as an advisory body to the Government of India in matters relating to agriculture. The objects of the Council are to undertake, aid, promote and co-ordinate agricultural and animal husbandry education, research and its application in practice, development and marketing in India by all means calculated to increase scientific knowledge of the subjects and to secure its adoption in every day practice; and to act as a clearing house of information not only in regard to research but also in regard to agricultural and veterinary matters generally.

Later on education and developmental work were also brought within the scope of the activities of the Council.

ORGANISATION

The Secretariat of the Council has been provided by the Government of India and is an attached office of the Ministry of Agriculture. The Minister for Agriculture in the Government of India is the President of the Council. The Principal Administrative Officer is the Vice-President who is an ex-officio Additional Secretary to the Government of India. He is also the chief adviser to the Central Government in matters relating to agriculture and animal husbandry. The Vice-President is assisted on the administration side by Secretaries who are ex-officio Deputy Secretaries to the Government of India, and on the technical side by Agricultural and Animal Husbandry Commissioners, and a Statistical Adviser. This separation of administrative and scientific duties has helped the scientific officers to devote undivided attention to scientific work, and the secretariat officers to maintain effective liaison with the Ministry of Agriculture, and to execute speedily proposals requiring Government sanction without the need for channelling them through the Secretariat of the Ministry of Agriculture.

FINANCE

The Royal Commission on Agriculture had recommended that for the use of the Council of Agricultural Research, a fund should be constituted by a grant of Rs. 50 lakhs from the Central Revenues to which additions should be made from time to time as financial condition warranted. The Government, however, decided to sanction an initial lump grant to be supplemented by a fixed grant annually. The initial grant was fixed at Rs. 25 lakhs of which Rs. 15 lakhs were provided in the budget for 1929-30. Commencing from 1930-31, the annual recurring grant was fixed at Rs. 7.25 lakhs per annum. The Government of India decided that the Council should have an entirely free hand in regard to the expenditure of grants made to it for research purposes. It was, however, soon felt that the Council had no source of income other than the grants from the Central Revenues. It was, therefore, thought necessary to place the Council in a more secure financial position with a stable income. It was, therefore, decided to obtain funds from an export cess on the value of certain agricultural commodities. The commodities selected for this purpose were the following:

Bones, bristles, butter, cereals other than rice and wheat, drugs, fibre for brushes, fish, fruits, ghee, raw hides, manures, oilcakes, pulses, spices, tobacco, vegetables, wool, etc.

In addition to the income from the cess levied, the Government of India make lump recurring grants for limited periods for specific purposes. The Council has also accumulated a reserve fund in the course of years in which it has been functioning.

Pattern of financial assistance

The Council does not possess any research institutions of its own, but sponsors agricultural research in conjunction with State Governments, Central and State Research Institutions, Universities and recognised private institutions. The institutions selected for executing research schemes of the Council are those which have facilities available with them for such research. Ordinarily the cost of the Council's schemes executed in State Research Institutions is shared in equal proportion by the Council and the State Governments, while schemes executed by Universities and Central and private institutions receive 100 per cent financial assistance. The advantage of this system of financing research is two-fold. It has helped to strengthen and expand the facilities available in Central and State Research Institutions with funds provided by the Council. It has also enabled the Council to function as a purely scientific society without unduly getting entangled in the administrative details inherent in the execution of such schemes. The Council interests itself mainly with schemes of regional or all-India importance; schemes of purely local aspects are, however, the direct responsibility of the respective State Governments. The Council's schemes are generally of short term duration and no scheme is ordinarily financed for more than 15 years., The Council's efforts are thus largely directed to initiate research, to undertake pilot developmental work where necessary and where promising results are obtained indicating the need for long term research to turn them over to the Central or State Governments for developing further work, so that the limited resources of the Council are utilised to the maximum advantage. Similarly it is one of the conditions of the Council's grants that approved results obtained through the Council's schemes will be exploited by the State Governments for the benefit of Indian farmers. Consequently except in the field of fundamental research and excluding the schemes initiated by the Council itself, the Council entertains only such schemes as are forwarded or recommended by the State Governments or Central Research Institutes.

HOW THE COUNCIL CONDUCTS ITS WORK

In developing the programme of research and scrutinising and approving research schemes, the Council functions mainly through a Governing Body, a Standing Finance Committee, an Advisory Board, a Board of Research, a number of Scientific Committees and Regional Committees. The Council also co-ordinates the activities of the Central Commodity Committees relating to research, and co-operates with them in initiating, promoting and undertaking schemes in the fields of common interest.

Governing Body

The Governing Body is the supreme body of the Council. All duties, powers, functions and rights necessary or consequential or incidental to carry out the objecive of the Society shall be performed by the Governing Body. It is also empowered to make, amend, or repeal any bye-laws relating to the administration and management of the Council. It passes the annual budget placed before it. It appoints members of the Scientific Committees on the recommendation of the Advisory Board.

The Governing Body consists of the following members :

- The President (Chairman)
- The Vice-President
- The Deputy Minister of Agriculture, Government of India, if any
- The Minister in charge of Agriculture in each of the States as specified in the First Schedule to the Constitution of India
- The Secretary to the Government of India in the Ministry of Agriculture
- Lieut. Governor/Chief Commissioner of each of the Union Territories as specified in the First Schedule to the Constitution of India
- Three persons selected out of the representatives of Parliament
- Two representatives of the Advisory Board to be elected by the Board from amongst its members
- Such other persons as the Minister of Agriculture, Government of India, may from time to time appoint.

Standing Finance Committee

The Standing Finance Committee scrutinises the annual statement of income and expenditure of the Council and submits it to the Governing Body with its recommendations. It examines estimates of all research schemes, scrutinises all proposals for creation of superior posts and performs such other functions as may be necessary in discharge of its duties.

The Standing Finance Committee consists of the following members :

- Secretary, Ministry of Agriculture (Chairman)
- Vice-President of the Council
- Financial Adviser to the Council
- Five members elected annually by the Governing Body of the Council from among themselves
- One member from among the members of the Lok Sabha
- Secretary of the Council is the ex-officio Secretary of the Committee

Advisory Board

The Advisory Board examines all proposals in connection with the scientific objects of the society relating to research and development in agriculture, animal husbandry, fisheries and allied subjects received by the Council. It also makes recommendations to the Governing Body in respect of appointment and composition of scientific committees. The Board generally attends to all matters as it may be requested to do by the Governing Body in furtherance of research and development activities in the sphere of agriculture, animal husbandry, fisheries, etc.

The Advisory Board consists of the following members :

- The Vice-President of the Society (Chairman)
- The Agricultural Commissioner with the Government of India, the Animal Husbandry Commissioner with the Government of India, and the Agricultural Extension Commissioner with the Government of India

The Agricultural Marketing Adviser to the Government of India
The Economic and Statistical Adviser, Ministry of Agriculture
The Statistical Adviser of the Society
The Director of the Indian Agricultural Research Institute
The Director of the Indian Veterinary Research Institute
The Director of the Indian Institute of Science, Bangalore
The Director of the National Dairy Research Institute, Karnal
The Director of the Central Rice Research Institute, Cuttack
The Director of the Central Potato Research Institute, Simla
The Director of Agriculture in each of the States of the Indian Union
The Director of Veterinary Services or of Animal Husbandry in each of the States of the Indian Union
Two representatives of the Union Territories on the Society nominated by the Government of India
The President of the Forest Research Institute, Dehra Dun
The member of the Society representing the Indian Council of Medical Research
The member of the Society representing the co-operative movement nominated by the Government of India
Four members of the Society representing the Indian Universities
The member of the Society representing the Indian Tea Association and the United Planters' Association of South India
The representatives on the Society of the Central Commodity Committees
The representative of the Coffee Board on the Society
The representative of the Rubber Board on the Society
The representative of the Fisheries Research Station nominated by the Government of India on the Society
Not more than five non-official members nominated by the Government of India on the recommendations of the Society on the ground of scientific knowledge or other special qualifications
Members of the Board of Research
The Director of Remounts, Veterinary and Farms, Army Headquarters, Ministry of Defence
Such other persons as the Minister of Agriculture, Government of India, may from time to time appoint. The duration of such appointment shall be for a period of three years.

Board of Research

The Board of Research guides the Advisory Board in respect of general policy on research in the sphere of agriculture, animal husbandry, fisheries and allied subjects. It makes recommendations to the Advisory Board for the purpose of testing results of research under actual farming conditions through pilot schemes. It also indicates priorities of research projects financed by the Council after having obtained recommendations of the relevant scientific committees. It reviews and co-ordinates research activities of the country as a whole in the fields of agriculture, animal husbandry and allied subjects. The Board is presided over by the Vice-President of the Council.

The Board of Research consists of the following members:

The Vice-President
The Agricultural Commissioner with the Government of India
The Animal Husbandry Commissioner with the Government of India
The Agricultural Extension Commissioner with the Government of India

Statistical Adviser to the Society

The Directors of the Central Research Institutes under the Ministry of Agriculture

The President, Forest Research Institute, Dehra Dun

The Chairmen of the Scientific Committees appointed by the Governing Body

A representative of each of the Central Commodity Committees referred to in Rule 2(33) nominated by the President of that Committee. Thus it helps to function as a body which can bring about effective co-ordination between the work of the Council and that of the Commodity Committees

Two representatives nominated by the Ministry of Community Development, one of whom shall be an Agricultural Officer and the other an Animal Husbandry Officer. Such other persons including officers of the Central and State Governments as the President may from time to time appoint.

In its actual working, the Board of Research functions through two Working Parties, viz. the Working Party on Agriculture and the Working Party on Animal Husbandry.

All members of the Board of Research pertaining to agriculture shall be members of the Working Party on Agriculture and all members of the Board of Research pertaining to animal husbandry shall be members of the Working Party on Animal Husbandry.

The Agricultural Extension Commissioner with the Government of India and Statistical Adviser of the Society are members of both the Working Parties.

The Agricultural Commissioner with the Government of India is the Chairman and Convener of the Working Party on Agriculture. The Animal Husbandry Commissioner with the Government of India is the Chairman and Convener of the Working Party on Animal Husbandry.

The Working Party meets, as and when considered necessary, to advise the Council on urgent matters of research, and recommendations made by it are placed before the Advisory Board at its annual meeting. Each Working Party after the meetings of the scientific committees also reviews programmes of research in its own sphere and prepares for the guidance of the Advisory Board notes on important matters of policy for the development of research on an all-India basis.

Scientific Committees

The Council has set up a number of scientific committees to examine research projects and report on research schemes and their working. The views of the Scientific Committees relating to research schemes are placed before the Board of Research and then before the Advisory Board. The following are the Scientific Committees of the Council:

Agriculture

(*i*) Plant Diseases Committee
(*ii*) Medicinal Plants Committee
(*iii*) Agricultural Engineering Committee
(*iv*) The Entomological and Animal Pests of Crops Committee
(*v*) Horticulture Committee
(*vi*) Floriculture Committee
(*vii*) Botany Committee
(*viii*) Agronomy Committee
(*ix*) Soil Science Committee
(*x*) Agricultural Economics Committee

(*xi*) Foodgrains Committee
(*xii*) Central Spices and Cashewnut Committee
(*xiii*) Vegetables Committee

Animal husbandry

(*i*) Animal Breeding Committee
(*ii*) Dairy Science Committee
(*iii*) Animal Nutrition Committee
(*iv*) Hides and Skins Committee
(*v*) Animal Diseases and Pests Committee
(*vi*) Wool Committee

General

(*i*) Statistical Committee
(*ii*) Publications Committee

Regional Committees

In order to ensure that there is no duplication of research work sponsored by the Council in different States, the Council has set up a number of Regional Committees. The Regional Committees examine the schemes put up by the States relating to the particular region. The whole country has been divided into a number of regions in accordance with the agro-climatological conditions. The following are the Regional Committees with respect to agriculture and animal husbandry.

Agriculture

1. Temperate Himalayan Regional Committee
2. Dry Northern Regional Committee
3. Eastern Regional Committee
4. Southern Regional Committee
5. Coastal Regional Committee

Animal husbandry

1. Temperate Regional Committee
2. Northern Regional Committee
3. Eastern Regional Committee
4. Southern Regional Committee

Publications

In order to disseminate results of research, the Council publishes a large number of journals, monographs, bulletins, pamphlets, etc. The publications range from technical communications useful only to trained research workers to non-technical ones written in a popular manner and in a simple language for the benefit of the layman. In addition, the Council has taken recourse to various types of audio-visual aids including cinematography in disseminating useful information. The Council thus ensures that the results of research programmes sponsored by it are carried both to the research personnel engaged in laboratories and experimental farms and the farmer working in the field.

The work of the Council has grown in volume as can be judged by comparing the data of income and expenditure.

In 1929 when the Council was started, its income and expenditure were Rs. 17,93,620 and Rs. 4,53,080 respectively, while today the figures under these heads are Rs. 73,14,000 and Rs. 57,23,900 respectively.

STATISTICAL WING OF THE I.C.A.R.

THE need for developing statistical methods for the formulation of correct agricultural policies and planning land use on sound lines is well recognised in modern times. The Indian Council of Agricultural Research has been endeavouring for over two decades now to meet this need in India.

The Statistical Wing of the Council had a humble beginning in a small Section set up in 1930 with a Statistician and a Computor as its only staff. To begin with, the function of the Section was to assist the provincial agricultural officers in planning their field experiments and analysing the experimental data. In 1933, the scope of the work was enlarged when it was decided that all technical programmes and progress reports of the research schemes sponsored by the Council should be scrutinised by the Statistician, and his views brought to the notice of the Advisory Board. By and by, the need for extending statistical methods to animal husbandry research also was realised, and in 1940 the work in this field was also assigned to the Section.

The activities of the Statistical Section expanded further towards the end of 1943 when it was decided that it should undertake research to bring about improvements through sampling methods in the content and quality of agricultural statistics, particularly those relating to production of food crops. By 1945, the usefulness of the work it was doing was well established, and it was reorganised as a full-sized branch under a Statistical Adviser and given a permanent status. Dr. P.V. Sukhatme who had been the Council's Statistician since 1940, and who had been largely responsible for the progress achieved, became the first Statistical Adviser. About the same time, regular courses of training in agricultural and animal husbandry statistics were instituted.

In 1955, the Statistics Branch along with Training Centre run by it was housed in separate premises, equipped with a good library, spacious reading rooms, good hostel accommodation and other necessary amenities. This new building is located near the Indian Agricultural Research Institute with a view to fostering closer association between the statistical staff and the specialists of the Institute, as also for providing a proper setting for the training programme.

As organised at present, the Statistical Wing comprises Advisory Units handling the statistical aspects of the Council's schemes, a Research Unit for evolving experimental techniques and planning methodological studies, a Project Unit for organising sample surveys, and a Training Unit. The activities of these various units are co-ordinated by the Statistical Adviser.

The advisory work, which is the most important function of the organisation, consists mainly in answering statistical enquiries from persons engaged in agricultural and animal husbandry experiments in the country, and advising on the statistical requirements of the Council's schemes.

Enquiries from the officers working on the Council's schemes relate mostly to the lay-out of experiments and interpretation of the data collected. Those received from other workers cover a wider field, and include requests for assistance in preparing plans for new surveys and for technical guidance in conducting them. To give a few examples, the Branch has already helped in the planning of studies relating to costs of production, wages of agricultural labour, yield and acreage of crops, livestock and fisheries, utilisation of cattle manure, etc. Sometimes the entire study is conducted by the Branch.

Scrutiny of the technical programmes, layout for experiments and progress reports of all Council's schemes is another important activity of the Branch. It also examines scientific papers from the statistical point of view before these are published in the Council's journals.

RESEARCH IN STATISTICAL TECHNIQUE

Statistical research in agriculture and animal husbandry is chiefly methodological, and aims at helping research workers by developing improved techniques for designing experiments and interpreting results. Comprehensive programmes of field and laboratory investigations are undertaken from time to time to evolve suitable sampling techniques for specific problems.

The research work carried out by the Branch has been of great value. For example, firstly it was found that in the case of several animal breeding schemes, sufficient basic information was lacking. This led to a close study of the data accumulating at various cattle and sheep breeding farms, and helped in making major improvements. Developing a sound method for assessing the breeding worth of a sire, determining the wool quality of various breeds of sheep, assessing the draught capacity of bullocks, and studying the problems in animal genetics, are some of the important contributions of statistical research in the field of animal husbandry. In agriculture, considerable work has been done on the design of sample surveys, design of horticultural experiments, determination of fertilizer response for various soil-types to different fertilizers, economics of manuring, etc. The research publications of the Organisation exceed 150 in number. A *Statistical News Letter* giving the activities of the Branch is also published quarterly.

Project work

Some of the important projects which have been completed in the past, or are in progress now, are mentioned below:

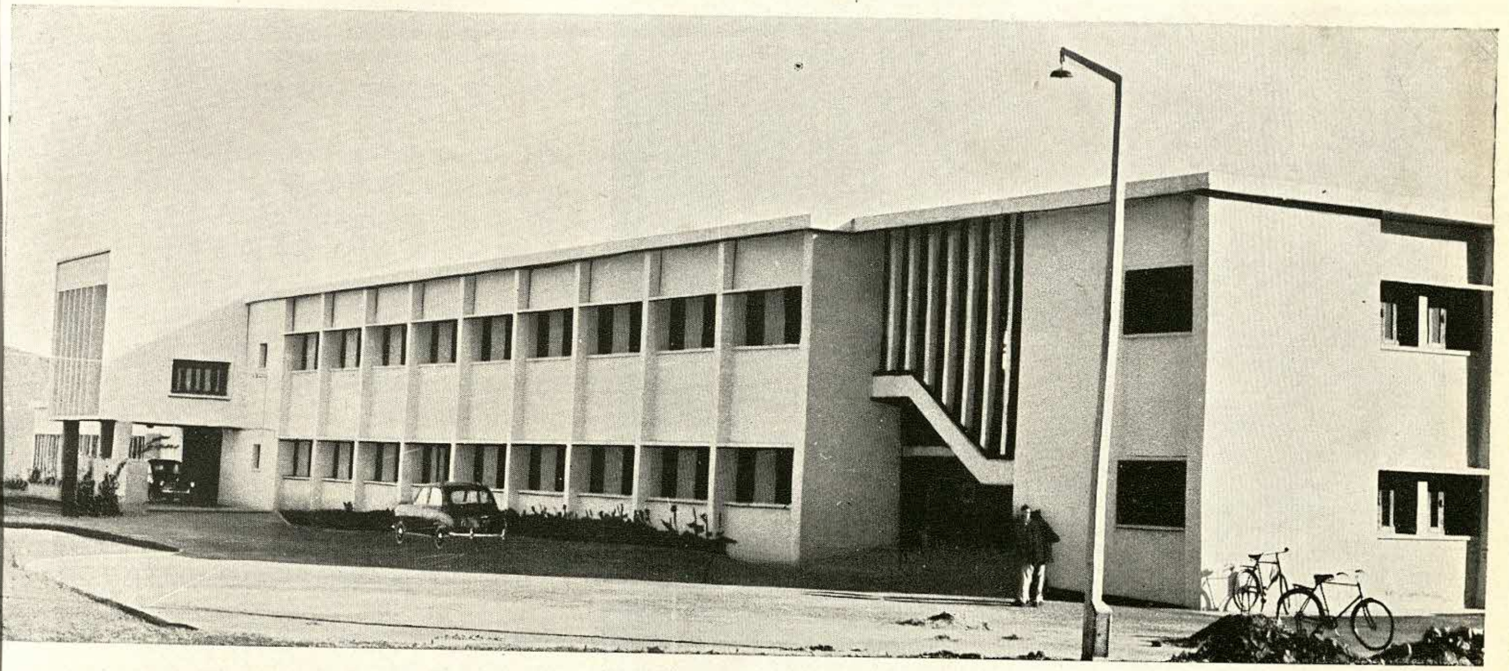
Estimation of crop yields. Beginning with 1944, the Organisation has conducted a series of pilot sample surveys for improving the estimation of production of food and other crops. The techniques evolved are being applied now on a country-wide scale through the National Sample Survey Organisation. Sampling techniques for estimating the areas under different crops were also developed.

Evaluation of the Grow More Food Campaign. The methods evolved by the Statistics Branch for assessing the increase in production as a result of various schemes launched under the campaign have been adopted by the National Sample Survey Organisation and the State Governments. The research done in this connection has led to the adoption of more realistic yard-sticks in programmes of agricultural development.

Experiment on cultivators' fields. The technique of conducting experiments on cultivators' fields, which was evolved by the Branch, is now being widely used in connection with many agronomic investigations. The Indian Council of Agricultural Research has already decided to conduct fertilizer experiments on cultivators' fields on a country-wide scale during the Second Plan period.

National Index of field experiments. A scheme has been initiated to maintain a running record of the results of all agricultural field experiments conducted in the country. Standard proformas and index cards have been designed for summarising the information for each experiment.

Survey of agronomic research. The Statistics Branch instituted in 1953 a survey of the current agronomic research. The information which is being collected includes among other things, the



Statistical Wing, Indian Council of Agricultural Research

Computing machines being operated, Statistical Wing, Indian Council of Agricultural Research

PLATE III]

Library of the Statistical Wing, Indian Council of Agricultural Research

Lecture in progress, Statistical Wing, Indian Council of Agricultural Research objectives of the experiments and the designs and treatments adopted. A scoring technique has been developed to measure the relative amount of information obtained on the treatments under study.

Survey of fertilizer practices. Pilot sample surveys for collecting information on the use of fertilizers and manures and connected cultivation practices are in progress in selected districts in different agricultural regions of the country.

Estimation of livestock numbers. A sampling technique of high precision for estimating the livestock numbers under various categories, which serves as a check on the census figures, and also provides information for the inter-census years has been developed through pilot surveys conducted in Madhya Pradesh, Uttar Pradesh and Bombay.

Estimation of fish-catch. A series of pilot sample surveys have been conducted during the last five years for estimating the marine fish catch. It has been shown that sampling can be successfully adopted for estimating the annual production in coastal areas through the locally stationed departmental agencies.

Study of milk yield and animal husbandry practices. A scheme for collecting information on milk yields and other aspects of animal husbandry, including breeding and management practices has been undertaken. The programme of work envisages covering of typical areas in the five animal husbandry regions of the country, in the Second Plan period.

Study of cost of milk production. The scheme aims at determining the cost of production of milk in urban as well as rural areas in selected regions. A sample survey carried out for two years in Delhi State has already provided very useful results. The survey is in progress in Madras and is now proposed to be extended to other areas.

Assessment of wool quality. An investigation is in progress for evolving a suitable technique of sampling wool from fleece as well as from commercial bales for the purpose of assessing quality.

Analysis of milk composition. The object of the study is to determine standards for milk quality.

TRAINING IN STATISTICS

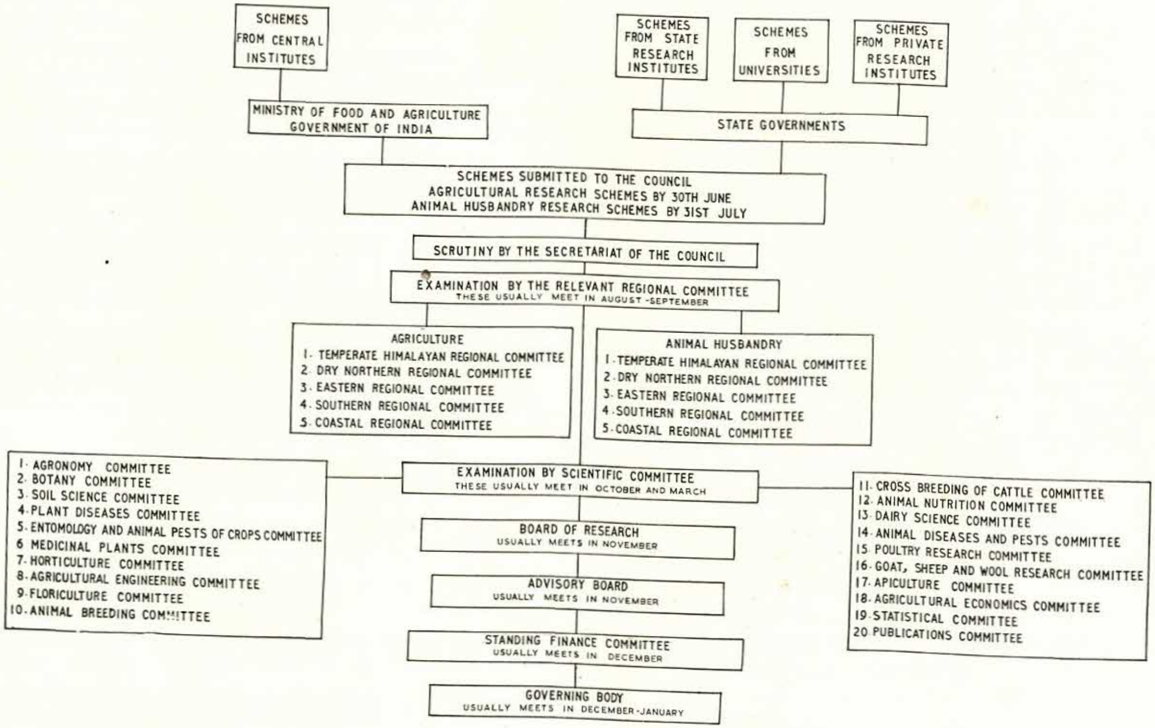
With the rapid expansion of agricultural statistics, a growing need was felt for instituting training courses for agricultural research workers as well as professionl statisticians. In the earlier years, training was provided on an individual basis, and this arrangement still continues on a limited scale to meet the special requirements of individual workers. The training programme has, however, taken a regular aspect with the institution of a Certificate Course of one year's duration for research workers in agriculture, animal husbandry, and allied sciences, and a Diploma Course of two years for statisticians. A short course of five months is also available for research workers who cannot take up the longer course. Admission is normally confined to 15 trainees for the Certificate Course, and to 10 for the Diploma Course. The Diploma Course includes lectures on pure and applied statistics and field practicals, in the first year, and investigation of a research problem or work on a satistical project, in the second year. Three scholarships of Rs 150 per month each are awarded every year to deserving students taking up the Diploma Course. Besides, two research fellowships of Rs. 200 per month each are granted for 2 years to selected trainees who complete the Diploma Course or possess equivalent qualifications. Two scholarships of Rs. 150/- per month each for a duration of two years and four scholarships of Rs. 150/- per month each for duration of one year are awarded every year to deserving students taking up the Diploma course. Besides this, six research fellowships of Rs. 200/- per month each are granted to deserving students in the 2nd year of the course. In addition, two fellowships of Rs. 200 and a scholarship of equal value are awarded by the Indian Council of Agricultural Research and the Ministry of Education respectively, for advanced studies in agricultural statistics leading to a research degree of a University. Two gold medals, called "Randhawa Prizes", are also awarded annually to the best students completing the Certificate and Diploma courses.

The training courses are reviewed from time to time to keep them abreast of the needs of agricultural and animal husbandry research. An Advisory Board has been constituted to guide the Council in policy matters pertaining to training programme.

The training facilities provided by the Statistics Branch have received wide notice, and already Indonesia, Jordan, Ethiopia, Liberia, Afghanistan, Ceylon, Burma and Nepal have deputed their workers for this training. The Branch has also collaborated with the F.A.O. in organising training centres. One on censuses and surveys was held in 1949, and another was organised in 1954 on experimental designs and survey techniques.

The Statistics Branch also arranges special seminars and refresher courses of a short duration for the benefit of senior research officers in agriculture and animal husbandry. Two such courses were organised in 1956 and 1957 for agricultural and animal husbandry officers, respectively. Further similar courses are also proposed to be arranged. A special training course in agricultural statistics and sampling was also conducted recently in collaboration with the Directorate of Economics and Statistics for the Land Records Officers of different States.

SUBMISSION OF RESEARCH SCHEMES TO THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH AND THEIR SANCTION


SCHEMES FROM CENTRAL INSTITUTES
SCHEMES FROM STATE RESEARCH INSTITUTES
SCHEMES FROM UNIVERSITIES
SCHEMES FROM PRIVATE RESEARCH INSTITUTES
MINISTRY OF FOOD AND AGRICULTURE GOVERNMENT OF INDIA
STATE GOVERNMENTS
SCHEMES SUBMITTED TO THE COUNCIL
AGRICULTURAL RESEARCH SCHEMES BY 30TH JUNE
ANIMAL HUSBANDRY RESEARCH SCHEMES BY 31ST JULY
SCRUTINY BY THE SECRETARIAT OF THE COUNCIL
EXAMINATION BY THE RELEVANT REGIONAL COMMITTEE
THESE USUALLY MEET IN AUGUST-SEPTEMBER
AGRICULTURE
1. TEMPERATE HIMALAYAN REGIONAL COMMITTEE
2. DRY NORTHERN REGIONAL COMMITTEE
3. EASTERN REGIONAL COMMITTEE
4. SOUTHERN REGIONAL COMMITTEE
5. COASTAL REGIONAL COMMITTEE
ANIMAL HUSBANDRY
1. TEMPERATE HIMALAYAN REGIONAL COMMITTEE
2. DRY NORTHERN REGIONAL COMMITTEE
3. EASTERN REGIONAL COMMITTEE
4. SOUTHERN REGIONAL COMMITTEE
5. COASTAL REGIONAL COMMITTEE
1. AGRONOMY COMMITTEE
2. BOTANY COMMITTEE
3. SOIL SCIENCE COMMITTEE
4. PLANT DISEASES COMMITTEE
5. ENTOMOLOGY AND ANIMAL PESTS OF CROPS COMMITTEE
6 MEDICINAL PLANTS COMMITTEE
7. HORTICULTURE COMMITTEE
8. AGRICULTURAL ENGINEERING COMMITTEE
9. FLORICULTURE COMMITTEE
10. ANIMAL BREEDING COMMITTEE
EXAMINATION BY SCIENTIFIC COMMITTEE
THESE USUALLY MEET IN OCTOBER AND MARCH
11. CROSS BREEDING OF CATTLE COMMITTEE
12. ANIMAL NUTRITION COMMITTEE
13. DAIRY SCIENCE COMMITTEE
14. ANIMAL DISEASES AND PESTS COMMITTEE
15. POULTRY RESEARCH COMMITTEE
16. GOAT, SHEEP AND WOOL RESEARCH COMMITTEE
17. APICULTURE COMMITTEE
18. AGRICULTURAL ECONOMICS COMMITTEE
19. STATISTICAL COMMITTEE
20 PUBLICATIONS COMMITTEE
BOARD OF RESEARCH
USUALLY MEETS IN NOVEMBER
ADVISORY BOARD
USUALLY MEETS IN NOVEMBER
STANDING FINANCE COMMITTEE
USUALLY MEETS IN DECEMBER
GOVERNING BODY
USUALLY MEETS IN DECEMBER-JANUARY

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH

Name of the scheme	States, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Rice breeding	Hyderabad	10 years (1944-54)	0.87	Breeding long duration varieties	H.R. 42 and H.R. 63 evolved	
Rice breeding	Kashmir	11 years (1941-52)	0.50	Evolve suitable high yielding types	Some strains evolved	
Rice breeding	Travancore	6 years (1943-49)	0.61	Evolution of improved strains, introduction of exotics and conduct of manurial experiments	Some high yielding strains evolved	
Seed multiplication	Orissa	2 years (1942-44)	0.30	To multiply and distribute improved paddy varieties	Objectives achieved	
Rice diseases	Madras	11 years (1943-54)	1.38	Investigation on blast and foot-rot diseases to devise control measures	C.O. 25, C.O.26, A.D.T. 25 T.K.M. 1, P.T.B. 1, resistant varieties evolved	
Paddy insect pests	W. Bengal	6 years (1949-55)	1.17	Study of insect pests and to devise control measures	BHC and DDT control pest effectively	
Rice vernalization	Calcutta University	3 years (1946-49)	0.21	Application of methods of vernalization and photoperiodism	High temperature had an accelerating effect on flowering and grain yield in summer varieties	
Breeding improved varieties of paddy	Madhya Pradesh	5 years (1954-59)	0.59	Breeding non-lodging, non-shedding and flood resistant paddy	Reports awaited	Current scheme
Breeding paddy for lift irrigation	Andhra Pradesh	3 years (1956-59)	0.49	To evolve strains suited for lift irrigation		do.
Rabi nurseries of paddy	Andhra Pradesh	4 years (1955-59)	0.25	To devise ways to hasten growth of seedlings during *rabi* season		do.
Bacterial blight of diseases of paddy	Bombay	3 years (1956-59)	0.17	To study diseases and devise control measures		do.
Rice stem borer	Madras	3 years (1955-58)	0.36	To study biology of stem borer and to evolve suitable methods of control		
Rice stem borer	Hyderabad	3 years (1955-58)	0.42	do.		do.

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Rice stem borer	W. Bengal	3 years (1955-58)	0.61	To study biology of stem borer and to evolve suitable methods of control		Current scheme
Rice stem borer	Andhra Pradesh	3 years (1955-58)	0.40	do.		do.
Helminthosporium disease of rice	W. Bengal	4 years (1949-53)	0.42	To study the incidence, spread and control of the disease	Object achieved	
Stem rot disease of rice	Madras	3 years (1955-58)	0.24	To study factors responsible for the disease and evolve suitable control	C.O.18, CH. 52 and ADT.9 varieties are resistant to disease. Growth of fungus inhibited by using solutions of Orthocide 50 and ceresan	do.
Rice breeding	Mysore	10 years (1949-59)	1.28	Selection of high yielding strains and introduction of new varieties	Some improved varieties were released for cultivation	do.
Rice breeding	Punjab	10 years (1949-59)	2.24	Selection of high yielding strains		do.
Improvement of hill paddy	Assam	5 years (1951-56)	0.41	Improvement of paddy cultivation in hill districts of Assam	Report awaited	
Boro paddy	W. Bengal	10 years (1949-59)	2.02	Selection of good yielding and high quality *boro* paddy and to study *aus* when grown as *boro*	Some strains were selected. *Bhut muri* (*aus* paddy) came up well when grown as *boro*	do.
Increasing rice yield	C.R.R.I.	5 years (1951-56)	1.33	To combine good-yielding and high-fertilizer response of *japonica* with hardiness of Indian varieties	Report awaited	
Survey and collection of paddy	C.R.R.I.	6 years (1952-58)	0.70	To study cultivated and wild types of rice from Jeypore tract	700 cultivated types and 23 wild types collected for study	do.
Physiology of rice flowering	W. Bengal	5 years (1952-57)	0.24	Study of fundamental physiology	Auxin concentration of nodes regulates the extension of growth of cereals	do.

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Rice physiology	Calcutta University	3 years (1955-58)	0.24	To investigate on the physiology of rice plant in relation to nutrient deficiency on metabolic process and to determine deficiency symptoms		Current scheme
Improvement of paddy	Madhya Bharat	5 years (1953-58)	0.51	To isolate high yielding strains of paddy		do.
Breeding varieties resistant to Piricularia	Madras	5 years (1953-58)	0.67	Evolution of short and medium duration varieties resistant to Piricularia		do.
Breeding varieties resistant to Piricularia	Andhra Pradesh	9 years (1948-57)	1.00	Evolution of long and medium duration blast resistant varieties		do.
Studies on paddy agromyzid fly	Hyderabad	2½ years (1953-56)	0.10	To survey the distribution of fly and to study the nature and extent of damage	Early sowing and transplantation reduces infection to a great extent	
Rice improvement	Kashmir	5 years (1953-58)	0.61	To study causes of rice diseases and evolve control measures		do.
Breeding salt and flood resistant varieties of paddy	Assam	5 years (1953-58)	0.56	To evolve high yielding flood resistant varieties	Varietiy Neghri Ban found to be highly flood resistant	do.
Breeding salt and flood resistant varieties of paddy	Travancore	5 years (1953-58)	0.85	To breed salt and flood resistant varieties	Kolappala variety gave higher yield than others	do.
Breeding salt and flood resistant varieties of paddy	W. Bengal	5 years (1954-59)	1.83	do.	4 new salt resistant strains evolved	do.
Scheme for work on rice in saline area	Andhra	5 years (1954-59)	0.79	To evolve rice varieties suitable for cultivation in saline areas	S.R.B.26, Cultures 10022 and 10034 evolved	do.
Blast and foot-rot diseases of rice and wheat	Bombay	7 years (1950-57)	1.18	Study of co-lateral hosts as also physiological races of organism	Report awaited	do.
Drought resistant strains of paddy	Kerala	5 years (1954-59)	0.84	To evolve superior drought resistant strains		do.
Deep water paddy	Andhra Pradesh	5 years (1953-58)	0.87	To evolve flood resistant varieties	A.R.108-1 and Culture 1311 evolved	do.

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Breeding strains resistant to lodging of rice	C.R.R.I.	5 years (1954-59)	0.86	To evolve strains resistant to to lodging		Current scheme
Japanese method of rice cultivation	Coorg	3 years (1953-56)	0.05	To test several factors concerned with the Japanese method	Object achieved	
Japanese method of rice cultivation	Mysore	3 years (1953-56)	0.05	do.	do.	
Japanese method of rice cultivation	Orissa	3 years (1953-56)	0.07	do.	do.	
Japanese method of rice cultivation	W. Bengal	3 years (1953-56)	0.05	do.	do.	
Japanese method of rice cultivation	Bihar	3 years (1953-56)	0.06	do.	do.	
Japanese method of rice cultivation	Madhya Pradesh	3 years (1953-56)	0.06	do.	do.	
Japanese method of rice cultivation	Uttar Pradesh	3 years (1953-56)	0.09	do.	do.	
Japanese method of rice cultivation	Bombay	3 years (1953-56)	0.075	do.	do.	
Japanese method of rice cultivation	Madras	3 years (1953-56)	0.045	do.	do.	
Japanese method of rice cultivation	Andhra Pradesh	3 years (1953-56)	0.05	do.	do.	
Rice quality (chemical)	Indian Instt. of Science	3 years (1934-37)	0.14	To study chemical qualities	do.	
Rice breeding	W. Bengal	12 years (1932-44)	2.00	To improve quality and yield of rice strains	Some improved strains evolved	
Rice breeding	Uttar Pradesh	12 years (1932-44)	2.03	do.	do.	
Rice breeding	Bihar	12 years (1932-44)	2.68	To evolve improved varieties	Few strains were evolved	
Rice breeding	Central Provinces	10 years (1932-42)	1.26	To provide basis for increasing the average yield of rice	Ten high yielding strains evolved	
Rice breeding	Assam	10 years (1934-44)	1.39	To evolve improved varieties	Some improved strains evolved	
Rice breeding	Orissa	7 years (1937-44)	1.18	To evolve better yielding varieties	Number of strains (including salt and flood resistant ones evolved	

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Rice breeding	Madras	7 years (1932-39)	1.07	To evolve better yielding varieties	2 strains yielding 25 per cent more evolved	
Rice breeding	Baroda	7 years (1940-47)	0.23	Improvement by selection in the open cultivated paddy grown as inter crop in between lines of cotton	No selection was possible	
Rice breeding	Burma	5 years (1932-37)	1.66	To investigate into the effects of soil and climate on the commercial quality of rice	Object achieved	
Rice development research	Madras	2 years (1942-44)	0.23	Multiplication and distribution of improved seeds	do.	
Rice seed multiplication	Uttar Pradesh	2 years (1942-44)	0.13	do.	do.	
Rice development research	Bengal	2 years (1942-44)	0.13	To multiply and distribute improved departmental strains	do.	
Introduction of improved varieties of rice	Central Provinces	2 years (1943-45)	0.12	To introduce improved strains	do.	
Rice physiology	Bombay	3 years (1932-35)	0.11	To study physiological process of rice plant	do.	
Rice pests	Central Provinces	2 years (1936-38)	0.05	To study the diseases and devise control measures	do.	
Rice diseases	Sind	4 years (1943-47)	0.07	Control of helminthosporium disease of rice	Agrosan pre-treatment of seeds gave good result	
Rice nutrition studies	Dacca	16 years (1930-46)	0.25	To study fixation and assimilation of N_2	Certain amount of nitrogen was fixed by blue green algae and rice plants assimilated this N.	
Rice quality (botanical)	Indian Instt. of Science	3 years (1934-37)	0.14	To study the botanical qualities	Object achieved	
Paddy insect pests	W. Bengal	2 years (1944-46)	0.05	To study the insect pests and disease control measures	do.	
Wheat breeding	Rajasthan	5 years (1953-58)	0.60	To evolve high yielding disease resistant strains	A few high yielding strains evolved	

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Maize breeding	Punjab	11 years (1946-57)	2.47	Improvement of maize crop		Current schemes
Maize breeding	I.A.R.I.	11 years (1946-57)	2.78	Production and maintenance of inbred lines		do.
Maize breeding	Uttar Pradesh	9 years (1950-59)	1.75	To improve through inbreeding		do.
Maize breeding	Bihar	7 years (1949-56)	0.96	Production of inbreds	Some high yielding varieties evolved	
Maize breeding	Andhra Pradesh	7 years (1950-57)	2.55	do.		do.
Maize breeding	Rajasthan	6 years (1951-57)	0.31	To test the American hybrids	Object achieved	
Maize breeding	PEPSU	5 years (1952-57)	0.47	To evolve hybrids		do.
Maize and paddy breeding	W. Bengal	10 years (1949-59)	2.50	To improve crop through inbreeding		do.
Co-ordinated wheat rust Scheme (Mycology)	I.A.R.I.	5 years (1951-56)	2.52	To evolve rust resistant varieties of wheat	Some resistant varieties evolved	
Co-ordinated wheat rust Scheme (Mycology)	Simla					
Co-ordinated wheat rust Scheme (Mycology)	Delhi					
Co-ordinated wheat rust Scheme (Mycology)	Agra					
Co-ordinated wheat rust Scheme (Botany)	Delhi					
Co-ordinated wheat rust Scheme (Botany)	Pusa					
Co-ordinated wheat rust Scheme (Botany)	Simla					
Co-ordinated wheat rust Scheme (Botany)	Indore					
Barley improvement	Rajasthan	4 years (1953-57)	0.27	To evolve high yielding disease resistant varieties	Varieties R.S. 27 and R.S. 30 evolved	
Sweet corn	Punjab	3 years (1951-54)	0.17	Import of hybrid seeds for trials	Object achieved	

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Hybrid corn seeds	Vivekananda Lab.	5 years (1952-57)	0.27	To test and multiply the exotic hybrids		Current scheme
Nutritive value of wheat	I.A.R.I.	4 years (1953-57)	0.93	To study chemical composition of Indian wheats		do.
Foot-rot of wheat	Madhya Pradesh	5 years (1954-59)	0.53	To study the causes for incidence		do.
Studies on wheat	Bombay	5 years (1954-59)	0.50	To try interspecific and intergeneric crosses of Indian wheats		do.
Hybrid maize	Mysore	3 years (1955-58)	0.54	To produce and distribute seeds of hybrids	Object achieved	do.
Cereal rust	Agra	19 years (1930-49)	3.12	To study the various aspects of disease	do.	
Testing barley varieties for rust resistance	Agra College	6 years (1943-49)	0.09	To test promising varieties of barley for resistance	B.183 (Kashmir) and B.33 (b) were resistant	
Wheat rust	I.A.R.I.	13 years (1935-48)	0.69	To evolve rust resistant varieties	Some N.P. resistant (N.P. 789, 801) rust strains evolved	
Control of wheat rust	Deccan	2 years (1943-45)	0.51	To propagate measures for control	Object achieved	
Investigation of pests of wheat and barley		18 years (1933-51)	0.49	To control diseases		
Pulse breeding	Madras	10 years (1943-53)	1.87	To evolve improved varieties	Three improved strains evolved	
Pules breeding	W. Bengal	10 years (1949-59)	1.12	do.		do.
Pules breeding	Madhya Pradesh	5 years (1953-58)	0.42	To improve pulses in Gwalior	Promising strains evolved	do.
Pulse breeding	Assam	5 years (1946-51)	0.42	To evolve high yielding pulses	2 *matkali* strains and one of *mung* evolved	
Pulse breeding	Hyderabad	10 years (1943-53)	1.03	do.	13 *tur* strains evolved	
Pulse breeding	Orissa	10 years (1943-53)	0.76	do.	Some improved strains evolved	

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Pulse breeding	Mysore	8 years (1943-51)	0.16	To evolve drought and disease resistant strains	11 strains of different pulses evolved	
Small millets	Mysore	8 years (1943-51)	0.16	To evolve drought resistant strains	6 strains evolved	
Gram wilt	Punjab	17 years (1943-59)	1.83	To devise control measures to check disease	Object achieved	Current scheme
Striga attack on Sorghum	Madras	5 years (1949-54)	0.94	To build homozygous strains resistant to Striga	Resistant hybrids (Co. 1xAS 4003 evolved	
Striga attack on Sorghum	Andhra Pradesh	5 years (1954-59)	0.75	do.	Selection of A.S. 8194 (1 and 31/1) evolved	do.
Hybrid cumbu	Madras	7 years (1950-57)	2.29	To evolve and distribute high yielding hybrids	Two hybrids evolved and distributed	do.
Jowar and *bajra* breeding	Bombay	6 years (1951-57)	1.20	To evolve high yielding strains	6 high yielding strains evolved	do.
Gram pests	Madhya Pradesh	2 years (1953-55)	0.09	To devise cheap control measures	D.DT sprays and dusting control pests	
Hybrid *bajra*	Bombay	3 years (1955-58)	0.75	To exploit hybrid vigour for increased production		
Diseases of *bajra*	Anand	6 years (1955-61)	0.30	To investigate smut and devise control measures		do.
Pulse research	Central Provinces	5 years (1943-48)	0.18	To increase production of pulses	4 high yielding strains evolved	
Pulses and millets research	Baroda	6 years (1943-49)	0.22	High yielding superior strains	Baleswar 12 and Medhi 33, best *moth* strains evolved	
Pulse research	Sind	6 years (1941-47)	0.11	High yielding superior strains	5 strains of *jowar* and 5 of gram selected	
Pulse research	N.W.F.P.	4 years (1943-47)	0.05	Improve the most important pulses	Local varieties collected and selections made	
Pulse physiology	Presidency College, Calcutta	3 years (1947-50)	0.13	To study effect of vernalization on seeds	Cold treatments produced early flowering in lentils	

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Soybean cultivation	Punjab	6 years (1944-50)	0.29	Selection of suitable strains for edible purposes	Punjab—1 strain selected	
Small millets	Central Provinces	5 years (1943-48)	0.06	To increase yield	Kodo No. 13 and Kutki No. 45 strains evolved	
Small millets	Bombay	5 years (1943-48)	0·11	To evolve better varieties	Some improved strains evolved	
Pulse breeding	Bombay	10 years (1941-51)	0.76	To evolve high yielding disease resistant strains	20 improved strains evolved	
Jowar storage pest	I.A.R.I.	4 years (1943-47)	0·34	To work out suitable methods to control pests	Suitable control measures evolved	
Jowar storage pest	Punjab	4 years (1943-47)	0.01	do.	do.	
Jowar storage pest	Bihar	4 years (1943-47)	0.01	do.	do.	
Jowar storage pest	Madras	4 years (1943-47)	0.01	do.	do.	
Jowar storage pest	Hyderabad	4 years (1943-47)	0.01	do.	do.	
Agronomic aspects of *jowar*	Madhya Pradesh	5 years (1954-59)	0.50	To study effect of different manures and cultural aspects		Current scheme
Storage and viability of pollen grains	Delhi Univerity	5 years (1954-59)	0.25	To study suitable conditions for storage of pollen grains		do.
Cytology of Indian grasses	Madhya Pradesh	3 years (1956-59)	1.50	To study the chromosome conditions of grasses		do.
Improvement of pasture and legumes	I.A.R.I.	5 years (1952-57)	1.59	Maintenance and study of grasses		do.
Improvement of pasture and legumes	Madhya Pradesh	6 years (1952-58)	0.75	do.		do.
Improvement of pasture and legumes	Bombay	5 years (1952-57)	1.25	To improve the grassland and grasses		do.
Research on fodder production	W. Bengal	5 years (1954-59)	0.43	To find suitable legumes for rotation		do.
Research on fodder production	Bihar	5 years (1954-59)	0.36	do.		do.

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Research on fodder production	Mysore	6 years (1954-60)	0.55	To find out suitable fodder types		Current scheme
Research on fodder production	Bhopal	6 years (1954-60)	0.16	To find out suitable types and their adaptability as catch crop		do.
Research on fodder production	Uttar Pradesh	5 years (1954-59)	0.66	To find out suitable fodder types		do.
Research on fodder production	Coorg	5 years (1954-59)	0.31	do.		do.
Research on fodder production	Hyderabad	5 years (1954-59)	0.68	do.		do.
Research on fodder production	Madras	3 years (1955-58)		do.		do.
Wheat physiology	Delhi University	3 years (1952-55)	0.38	To study physiology of growth and development	Progressive fall in grain yield observed in early varieties	
Cytological studies on crop plants	Andhra University	3 years (1953-56)	0.10	To acquire knowledge of cytology of crop plants	Object achieved	
Use of phytohormones for higher yields	Bombay	3 years (1955-58)	0.67	To find the optimum dosage for higher yield		do.
Chemical stimulation of ovules	Delhi University	5 years (1953-58)	0.50	To Study of the chemical stimulation of ovule		do.
Mechanism of polyploidy	I.P.I., Indore	3 years (1953-56)	0.32	To investigate change in activities of enzymes during polyploidisation	Report awaited	
Plant physiology and plant introduction	Vivekananda Laboratory, Almora	5 years (1954-59)	2.25	To establish a plant introduction station		do.
Establishment of a neucleus organisation	I.A.R.I.	10 years (1946-56)		To introduce and maintain economic plants	9703 samples of planting material obtained	
Pre-soaking seeds in nutrient salts	Coimbatore	5 years (1952-57)	0.14	To improve crop yields	Report awaited	
Grassland Reconnaissance Survey Scheme	I.C.A.R.	5 years (1954-59)	2.88	To study various grassland communities		do.

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Coordinated wheat rust control	Mahableshwar	5 years (1951-56)		To evolve varieties resistant to rusts	Some rust resistant strains evolved	
Coordinated wheat rust control	Niphad		2.23			
Coordinated wheat rust control	Powerkheda		2.21			
Coordinated wheat rust control	Hyderabad					
Coordinated wheat rust control	Kanpur					
Coordinated wheat rust control	Gurdaspur					
Turmeric	Andhra Pradesh	6 years (1953-59)	0.79	To improve the productivity and quality of turmeric		Current scheme
Ginger	Assam	5 years (1954-59)	0.83	Botanical and agronomical improvement of ginger		do.
Ginger	Madras	10 years (1950-60)	0.69	Investigating important problems affecting cultivation of ginger	Crops grown under trees gave better yield than the open. Bordeaux mixture at 1% had deleterious effect on germination. Gammexane resulted in extra yield of ripe chillies	
Chillies	Andhra Pradesh	8 years (1949-57)	0.98	To isolate a thrip-resistant and prolific variety		
Chillies	Uttar Pradesh	5 years (1954-59)	0.43	To undertake investigations for improvement of chillies		do.
Chillies	Hyderabad	6 years (1954-60)	0.73	do.		do.
Chillier	I.A.R.I.	7 years (1953-60)	0.53	To evolve an improved variety of chillies		do.
Chillies	Bombay	6 years (1953-59)	0.45	do.		Transferred to Mysore State on re-organisation

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Chillies	Madras	5 years	0.37			Scheme current
Insect infestation of exported pepper	Madras	1 year (1955-56)	0.04	To find out causes of insect infestation of exported pepper	Fumigation with cholorosal was effective against insect pest. Provision of Alkathene film inside gunnies prevented mouldiness	
Insect pests of stored pepper	Travancore-Cochin	1 year (1954-55)	0.01	Investigating damage caused by insect pests of stored pepper		
Scientific aid to pepper industry in S. India	Madras	11 years (1949-60)	3.27	Evolution of higher yielding varieties. Control of insect pests and diseases and collection of data regarding the manurial requirements	Layering gave better success than propagation through cuttings. Rainy season most suitable for layerings or planting cuttings. Production of spikes was sparse under thick shade	do.
Cardamom	Coorg	5 years	0.94	To study the life history of hairy caterpillar pest and evolution of control measures		do.
Research on cardamom survey	Madras	10 years (1944-54)		To investigate ways and means of controlling the pests and diseases and to bring the yield to normal by selection and hybridisation	The entomological problems have nearly been solved	
Cloves	Kerala	8 years (1945-53)	0.10	To investigate the problems concerned with plantation, management and thus to popularise clove cultivation in the State	Seedlings raised with watering and heavy shading were found to be healthier and more vigorous	
Cardamom	Madras	10 years	1.68	Work on crop selection and breeding and control of main pests and diseases	Effective method of controlling 'Taeniothrips evolved	
Cardamom	W. Bengal	6 years (1954-1959)		Control of *Foorki* disease		do.
Cardamom	Bombay	3 years	0.23	Control of *Katee* disease	Report awaited	

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Cardamom	Mysore	3 years	0.31	Control of *Katee* disease	Report awaited	
Cardamom	Kerala	3 years	0.42	do.	do.	
Cardamom	I.A.R.I.	3 years	0.03	do.	do.	
Research station for cardamom	Travancore-Cochin	3 years (1955-58)		—	—	Scheme current
Research station for cardamom	Mysore	4 years (1956-60)	0.76	—	—	do.
Cardamom	Coorg	5 years	0.94	To study the life history of hairy caterpillar pest and evolution of control measures		do.
Cashewnut development	Madhya Bharat	1 years (1955-56)	0.05	Establishment of research-*cum*-nursery centre for large scale cashew cultivation	A nursery centre has been established	
Cashewnut development	Kerala	4 months (1957)	0.11	Extension of cashewnut production in fallow and waste areas	—	do.
Cashewnut development	Mysore	3 months	0.06	Extension of cashewnut cultivation	—	
Research on pests and diseases affecting cashew plantations	Madras	2 years (1956-58)	0.12	To assess the nature and incidence of pests and diseases affecting cashew plantations	Major disease noted was die-back caused by *Pellicularia salamonicolor*; Parathion found effective	Transferred to Mysore State after re-organisation
Pepper development	Madras	2 years (1955-57)	2.09	Replacement of old uneconomic vines in existing plantations and extension of cultivation in new areas	35,442 rooted pepper cuttings and 19,450 unrooted pepper cuttings of selected vines were distributed during the first year	
Turmeric development	Orissa	1 year (1957-58)	0.07	Development of turmeric cultivation	do.	Scheme current
Trace elements in Indian soil	I.A.R.I.	9 years (1944-53)	0.76	To investigate remedies for deficiencies due to trace elements in soils and plants	Diseased leaves of citrus were low in Mn. and Zn. Leaves from South were particularly deficient in copper and Zn. Manures and fertilisers bore better crops	

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Study of the physical properties of certain chemical fertilizers under storage conditions	I.A.R.I.	1 year and 8 months (1953-54)	1.87	To compare new types of fertilizers with ammonium sulphate under varying conditions of storage	Ammonium sulphate was more hygroscopic, formed harder cakes, was more stable than other fertilizers. Alkathene lined bags with jute overbags minimised the damage	
Sewage farming	I.I. Sc., Bangalore	8 years (1942-50)	1.06	To study aspects of land treatment of sewage and sewage farming	Fodder grasses and other crops grown on well drained, porous soils responded well to sewage irrigation	
Sub-surface investigation	Sindh	3 years (1940-43)	0.24	To classify soils suitable for agriculture and study their behaviour under irrigation	Objects achieved	
Water requirements of crops	Punjab	7 years (1940-47)	1.16	To study water requirements of crops in relation to various kinds of soils	In case of wheat, manures decreased the water cost. In case of cotton, water cost minimised with 16 in. irrigation. In case of sugarcane water cost was minimum at 48 in. irrigation	
Pathogens in night soils	All India Hygiene Instt. Calcutta	2 years (1953-55)	0.14	To examine samples of night soil compost for pathogens and study them under different conditions	Useful results obtained in the laboratory are now being confirmed in the field	
Monograph on dry farming in India	I.C.A.R	1 year (1940-41)	0.06	To write monograph on dry farming	Objects achieved	
Dry farming	Madras	10 years (1933-43)	1.68			
Dry farming	Bombay	10 years (1933-43)	0.33			
Dry farming	Punjab	8 years (1935-43)	1.64	To improve existing methods of farming for obtaining better yield	It was found that (*i*) Scooping was superior to bunding (*ii*) Bunded plots gave higher yields (*iii*) Lower seed rate with F.Y. manure and frequent interculture gave best results	
Dry farming	Madras	5 years (1943-48)	0.24			
Dry farming	Hyderabad	10 years (1933-43)	0.08			

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Dry farming	Hyderabad	4 years (1943-47)	0.24			
Phenological observations	Bombay	1 year (1946-47)	0.15			
Group weather coordination,	Poona	5 years (1945-50)	1.12			
Nitrogen loss and nitrogen fixation in soils	Allahabad University	4 years (1936-40)	0.10	To study nitrogen losses and its fixation in soils	Nitrogen fixation took place by the addition of *neem* cake (in the presence of sunlight), molasses and cellulosic substance to the soil. Nitrogen losses were greater in light than in darkness	
Crop production by catalysis	I.I.Sc., Bangalore	6 years (1944-50)	0.36	To study application of chemical compounds to soil to promote microbial activity and help in release of more plant food	Application of-ferrous sulphate or magnesium sulphate with organic manure as basal dressing increased yield	
Colloid soils	Calcutta University and I.A.R.I.	18 years (1930-48)	1.34	To study reaction of colloidal soils under different conditions	Base exchange capacity increased as size of particles diminished, specific conductivity of colloidal solutions of clay salts did not vary with concentrations	
Bonemeal	I.A.R.I.	1 year (1952-53)	0.05	To find out methods for powdering bones on cottage industry basis for use as fertilizer and cattle feed	Jungle dried bones treated with hydrochloric acid formed a balanced bone-manure and calcium phosphate of fertilizer grade, being fragile could be used on cottage industry scale	
Dry farming and soil conservation	Madhya Pradesh	3 years (1954-57)	0.22	To study the most suitable methods of soil and water conservation under local topographical and climatic conditions and cultural practices		Scheme transferred to the Soil Conservation Board
Dry farming and soil conservation	Bhopal	3 years (1954-57)	0.11	do.		do.

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Soil erosion	Vishwa Bharati	3 years (1944-47)	0.05	To investigate methods for preventing soil erosion and relcaiming badly eroded areas	Useful results obtained in laboratory are being now confirmed in fields	
Preparation of cheap and synthetic manure from town refuse and waste material	Bangalore	7 years (1935-42)	0.25	To bring down nitrogen losses to a low level and to promote progressive humification of manure	Twice the quantity of manure containing the same amount of organic matter and nitrogen could be produced	
Fertilizers Committee	I.I.Sc.	14 years (1929-44)	0.02	To investigate problems for conservation of indigenous manurial resources	Object achieved	
Fundamental characteristics of Indian soils	Punjab	1 year (1946-47)	0.02	To compare various methods of soil analysis	Object achieved	
Work on problems relating to coastal soils	Calcutta	7 years (1939-46)	0.30	To collate experimental materials in the study on coastal soils	Development of pans could be controlled by planting deep rooted trees, better drainage with the treatment of calcium carbonate and superphosphate	
All India soil survey		6 years (1941-47)	0.84	To collect data on various soils of the country	Country divided into eight different soil regions	
Organic constituents of Indian soils	Dacca	8 years (1934-42)	0.12	To study the sources of organic matter and its reaction in soils	Objects achieved	
Analysis of laterite soils	Dacca	12 years (1930-42)	1.00	To study lateritic soils and the assimilation of nitrogen by rice plant	The maximum water holding capacity increased on saturating soil with lime at pH 7.1. Saturation capacity increased with the depth of soil	
Soil and plant growth (humification of organic matter)	Agra	5 years (1953-58)	0.27	To study the physico-chemical properties of Agra soils on humification of organic matter		Scheme current
Phosphorus nutrition of crops	Andhra Pradesh	3 years (1956-59)	0.11	To study the effect of cultural and manurial practices on the availability of added phosphates in paddy soils under swamp conditions		do.

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Experiments on Kotka phosphate and dicalcium phosphate	I.C.A.R.	2 years (1955-57)	0.08	To try the fertilizers on various soil zones containing citrate soluble superphosphate	Experiments in progress	Current scheme
Award of a prize for soil moisture determination	I.C.A.R.	1 year (1954-55)	0.1000	To design a portable instrument for soil moisture determination	Not yet finalised	
Extensive simple manurial trials under T.C.A. project	I.A.R.I.	1 year (1954-55)	0.60	To conduct simple trials with new type fertilizers in cultivaters' fields	Objects achieved	
Usar land reclamation	Sheila Dhar Institute	3 years (1954-57)	0.25	To study causes leading to the formation of alkali soils	Experiments in progress	do.
Nitrogen fixation in soils	Sheila Dhar Institute	3 years (1954-57)	0.25	To study the fixation of nitrogen in soils	do.	do.
Studies on microflora of soils	Bangalore	3 years (1954-57)	0.66	To undertake microbiological analysis of soils and to propagate earthworms and study their role in the alteration of soil microflora	do.	do.
Collection of soil survey data	I.A.R.I.	3 years (1954-57)	0.56	Collection of the soil survey and agronomic data in India and prepare its report	do.	do.
Electric methods of hygrometry		4 years (1934-38)	0.03	To study affects of electrical resistance of a carbon line on the humidity	Object achieved	
Standardisation of physico-chemical single value measurements for Indian soils	Bombay	7 years (1930-37)	0.05	To standardise methods of physico-chemical measurements and to study Indian soils	do.	
Physico-chemical properties and fertility of soil	Punjab	3 years (1931-34)	0.09	To study fertility of soils of Kalabagh	Soils deficient in potassium, phosphorus and nitrogen improved after addition of manures	

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Manurial experiments	Madras	3 years (1952-55)	0.43	To find out responses of manures to soil types and recommended manurial schedule to cultivators	Yield of grain and straw of paddy increased with basal dressing of green manure plus superphosphate and ammonium sulphate	
Manurial experiments	W. Bengal	3 years (1952-55)	0.62		Phosphate to paddy and potash to jute with the ammonium sulphate gave maximum yield	
Manurial experiments	Bihar	3 years (1953-56)	0.70		A combination of nitrogen and phosphorus gave increased yields of wheat and paddy	
Manurial experiments	Bombay	4 years (1953-57)	0.60			Scheme current
Manurial experiments	Pepsu	4 years (1953-57)	0.44			do.
Manurial experiments	Punjab	4 years (1953-57)	0.47			do.
Manurial experiments	Bhopal	3 years (1954-57)	0.55			do.
Weed control	Poona	2 years (1954-56)	0.48	To select obnoxious weeds and eradicate them by means of herbicides		
Weed control	Madras	3 years (1953-56)	0.07			
Weed control	W. Bengal	3 years (1953-56)	0.51			
Weed control	Assam	3 years (1953-56)	0.03			
Weed control	Madhya Bharat	2 years (1954-56)	0.04			
Weed control	Himachal Pradesh	2 years (1954-56)	0.10			

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Weed control	Madhya Pradesh	3 years (1953-56)	0.03			
Weed control	Bhopal	3 years (1953-56)	0.09			
Alkali reclamation	Andhra Pradesh	4 years (1955-59)	0.43	To investigate methods for reclamation of saline and alkaline lands		Scheme current
Usar land reclamation	Punjab	3 years (1956-59)	0.36	To reclaim alkali soils		do.
Clay mineral contents of Indian soils	W. Bengal	3 years (1955-58)	0.14	To study clay mineral contents of typical Indian soils and their retention and release of plant nutrients		do.
Soil conditioners	W. Bengal	3 years (1954-57)	0.11	To prepare Krilium type polymers and study their effect on soil aggregation		do.
Legume seed inoculation	W. Bengal	4 years (1955-59)	0.13	To study factors affecting seed inoculation under different conditions and causes of failures of crops after seed inoculation		do.
Phenological observation	Poona	3 years (1954-57)	0.16	To study influence of climate on animal and vegetable life		do.
Green manuring crops	Bihar	3 years (1955-58)	0.19	To investigate green-manure crops for different regions of the country and to fix them in crop rotation		do.
Green manuring crops	CRRI	3 years (1955-58)	0.40			do.
Green manuring crops	ICJC	3 years (1955-58)	0.44			do.
Green manuring crops	Himachal Pradesh	3 years (1955-58)	0.19			do.
Green manuring crops	Hyderabad	4 years (1956-60)	0.17			do.

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Green manuring crops	Mysore	3 years (1956-59)	0.15			Scheme current
Phosphatic reversion in Nilgiris	Madras	4 years (1956-60)	0.15	To study phosphate fixation in laterite soils of the Nilgiris, its effect on crop growth (potatoes)		do.
Reclamation of saline and alkaline lands	Madras	3 years (1956-59)	0.25	To reclaim alkali soil		do.
Nitrogen fixation	Bombay	4 years (1956-60)	0.19	To investigate nitrogen fixing power under different conditions and study its economics		do.
Rapid soil test	I.A.R.I.	3 years (1954-57)	1.25	To examine the four available rapid soil test kits for different soil types for mass testing		do.
Nitrogen fixation	Madhya Pradesh	3 years (1954-57)	0.13	To study the nitrogen fixation power of selected leguminous crops		do.
Soil standardisation methods	Bombay	6 years (1954-60)	0.85	Examination of the existing methods of soil analysis		do.
Micro-nutrient studies	Punjab	3 years (1956-59)	0.15	To study micro-nutrients and their diseases in soils and crops of Punjab		do.
Micro-nutrient status of soils	Bombay	5 years (1954-59)	0.38	do.		do.
Azotobacter inoculation of crops	W. Bengal	6 years (1951-57)	0.13	To test suitability of W. Bengal soils for azatobactor growth		do.
Nitrogen fixation in soils	I.A.R.I.	6 years (1947-53)	0.39	To study nitrogen fixation by root nodule bacteria of leguminous plants	*Arhar* manured with ammonium sulphate gave best yields and also fixed atmospheric nitrogen	
Nitrogen fixation	Andhra Pradesh	3 years (1956-59)	0.18	To determine the nitrogen fixation power of different leguminous crops		do.

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Usar land reclamation	Lucknow	4 years (1956-60)	3.7	To reclaim *usar* lands by different methods		Scheme current
Composition of plants in *usar* land	Lucknow	4 years (1956-60)	0.43	To find out alkalinity and salinity on the composition of crops plants		do.
Simple fertilizer trials	Assam	5 years (1956-61)	0.19	To study the response of nitrogen, phosphorus and potash alone or in combinations with crop growth and yield		Plan scheme
Simple fertilizer trials	Punjab (three centres)	5 years (1956-61)	1.26			do.
Simple fertilizer trials	Madras	5 years (1956-61)	0.56			do.
Simple fertilizer trials	Madhya Pradesh (two centres)	5 years (1956-61)	0.70			do.
Simple fertilizer trials	Rajasthan	5 years (1956-61)	0.20			do.
Simple fertilizer trials	Kerala	5 years (1956 61)	0.41			do.
Simple fertilizer trials	Orissa (two centres)	5 years (1956-61)	0.72			do.
Simple fertilizer trials	Bombay (two centres)	5 years (1956-61)	1.91			do.
Simple fertilizer trials	Bihar	5 years (1956-61)	0.74			do.
Simple fertilizer trials	Delhi	5 years (1956-61)	0.10			do.
Simple fertilizer trials	Himachal Pradesh	5 years (1956-61)	0.28			do.
Simple fertilizer trials	Uttar Pradesh	5 years (1956-61)	2.72			do.
Simple fertilizer trials	W. Bengal	5 years (1956-61)	0.89			do.
Simple fertilizer trials	Mysore	5 years (1956-61)	1.18			do.
Simple fertilizer trials	Assam	5 years (1956-61)	0.19			
Simple fertilizer trials	Andhra (two centres)	5 years (1956-61)	0.90			
Simple fertilizer trials	I.A.R.I.	5 years (1956-61)	0.11			

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Model agronomic experiments	Assam		0.09	To study agronomic practices, irrigation and fertiliser requirements of crops in different soils		Plan schemes
Model agronomic experiments	Andhra Pradesh (three centres)	5 years (1956-61)	0.72			
Model agronomic experiments	Bihar		0.23			
Model agronomic experiments	Bombay (four centres)		1.03			
Model agronomic experiments	Madhya Pradesh (four centres)		0.98			
Model agronomic experiments	Madras (two centres)		0.46			
Model agronomic experiments	Mysore (two centres)		0.58			
Model agronomic experiments	Orissa (three centres)		0.40			
Model agronomic experiments	Punjab (two centres)		0.30			
Model agronomic experiments	Rajasthan		0.26			
Model agronomic experiments	Kerala		0.27			
Model agronomic experiments	Uttar Pradesh (three centres)		0.62			
Model agronomic experiments	W. Bengal		0.44			
Model agronomic experiments	Jammu & Kashmir		0.12			
Model agronomic experiments	Coorg		0.24			
Model agronomic experiments	Andhra Pradesh (two centres)					
Model agronomic experiments	Madhya Bharat		0.20			

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—*(Contd.)*

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Production and trial of agricultural implements	I.A.R.I.	6 years (1953-54 to 1958-59)	1.39	(*i*) To try the suitability of some Japanese agricultural implements (*ii*) To introduce improved agricultural implements from one part of the country to another where they are not known, through demonstration	Reports awaited	
Survey of indigenous implements	I.A.R.I.	3 years (1955-58)	0.28	To collect all relevant information regarding agricultural field implements in use in various States with a view to providing basic data for carrying out further improvements	do.	
Survey of indigenous implements	Bihar	1 year (1954-55)	0.17	do.	do.	
Survey of indigenous implements	Madras	1 year (1954-55)	0.16	do.	do.	
Survey of indigenous implements	Uttar Pradesh	1 year (1954-55)	0.18	do.	do.	
Survey of indigenous implements	Punjab	1 year (1954-55)	0.27	do.	do.	
Survey of indigenous implements	Bombay	1 year (1954-55)	0.20	do.	do.	
Survey of indigenous implements	Assam	1 year (1954-55)	0.19	do.	do.	
Survey of indigenous implements	Madhya Pradesh	1 year (1954-55)	0.18	do.	do.	
Survey of indigenous implements	W. Bengal	1 year (1954-55)	0.18	do.	do.	
Survey of indigenous implements	Orissa	1 year (1954-55)	0.17	do.	do.	
Survey of indigenous implements	Hyderabad	1 year (1954-55)	0.16	do.	do.	

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned Rs. in lakhs)	Objectives	Achievements	Remarks
Survey of indigenous implements	Madhya Bharat	1 year (1954-55)	0.17	To collect all relevant information regarding agricultural field implements in use in various States with a view to providing basic data for carrying out further improvements	Report awaited	
Survey of indigenous implements	Mysore	1 year (1954-55)	0.14			
Survey of indigenous implements	Andhra Pradesh	1 year (1955-56)	0.17			
Survey of indigenous implements	Rajasthan	1 year (1954-55)	0.19			
Survey of indigenous implements	Kerala	1 year (1954-55)	0.15			
Survey of indigenous implements	Bhopal	1 year (1954-55)	0.17			
Survey of indigenous implements	Coorg	1 year (1954-55)	0.18			
Survey of indigenous implements	Himachal Pradesh	1 year (1954-55)	0.08			
Survey of indigenous implements	Vindhya Pradesh	1 year (1954-55)	0.19			
Survey of indigenous implements	I.C.A.R.	4 years (1954-58)	0.11			
Training village blacksmiths	Assam	1 year (1954-55)	0.04	To impart training to blacksmiths from rural areas in the technique and repairs of improved agricultural implements	The candidates were trained in the technique of repairs of improved agricultural implements	
Training village blacksmiths	Orissa	1 year (1954-55)	0.02	do.		
Training village blacksmiths	Assam	1 year (1954-55)	0.02	do.	do.	
Training village blacksmiths	Madras	1 year (1954-55)	0.07	do.		
Training village blacksmiths	Hyderabad	1 year (1954-55)	0.04	do.	do.	
Training village blacksmiths	Vindhya Pradesh	1 year (1954-55)	0.02	do.	do.	
Improved axles and hubs	I.A.R.I.	—	0.02	To test the suitability of some improved axles and hubs in bullock carts	Reports awaited	
Award of prizes for improvement in agricultural implements	I.C.A.R.	3 years (1956-59)	0.30	Improvement in agricultural implements in the country	do.	Scheme current

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Research Fellowships in Agriculture	Bombay (3 centres)	3 years (1955-58)	0.12	To develop and encourage agricultural education and research in the country		
Research Fellowships in Agriculture	Kerala		0.03			
Research Fellowships in Agriculture	Uttar Pradesh	4 years (1955-59)	0.33	do.		
Research Fellowships in Agriculture	Andhra Pradesh	4 years (1955-59)	0.03	do.	17 Junior fellowships for study leading to M.Sc. degree and 15 Senior fellowships leading to Ph.D Degree awarded in different subjects up to 1956	Scheme current
Research Fellowships in agriculture	I.A.R.I.	4 years (1955-59)	0.13	do.		do.
Research Fellowships in Agriculture	I.V.R.I.	4 years (1955-59)	0.54	do.		
Research Fellowships in Agriculture	I.C.A.R.	4 years (1955-59)	0.50	do.		
Research Fellowships in Agriculture	Madras	4 years (1955-59)	0.08	do.		
Research Fellowships in Agriculture	Other States, etc.	4 years (1955-59)	1.51	do.		
Research Fellowships in Agriculture	Punjab	4 years (1955-59)	0.08			
Research Fellowships in Agriculture	W. Bengal	4 years (1955-59)	0.03			do.
Manufacture of wine	I.C.A.R.	2 years (1945-47)	0.04	Experimental work on the manufacture of wine in India		do.
Indian Institute of fruit technology	I.C.A.R.	(2 years 1948-50)	2.38	To counduct fundamental and applied researches in fruit and vegetable preservation industry in technical matters to analyse fruit products according to the specifications of F.P.C.O. and to conduct short and long courses in fruit technology	—	This Institute has been merged with the C.F.T.R.I., Mysore
Indian Institute of fruit technology	I.C.A.R.	2 years (1945-47)	0.12			
All-India Mango Show	I.C.A.R.	1 year (1955-56)	0.34	To bring out the varietal wealth of mangoes of the country and promote healthy rivalry for fruit development among the growers	Two All-India Mango Shows, one in Bombay and the other in Delhi, were held in 1955	
Potato seed certification survey	I.A.R.I.	7 years (1942-49)	1.48	To carry out survey of areas for production of disease-free seed potato		Transferred to C.P.R.I. since 1949

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Citrus manurial trials	Punjab	11 years (1948-59)	0.41	To determine manurial requirements of citrus trees in the Punjab	Ammonium sulphate alone and in combination with farm yard manure gave significantly better results	
Description of different varieties of fruits	I.C.A.R.	12 years (1948-60)	2.22	To describe the characteristics of different varieties of fruits for purposes of identification	A monograph on " Mango " is under print	
Banana research	Madras	11 years (1949-60)	2.76	To evolve better high yielding and disease resistant varieties of banana		Scheme current
Banana research	Bombay	11 years (1949-60)	1.55	do.		do.
Banana research	W. Bengal	10 years (1949-59)	2.73	do.		do.
Improvement of *ber* fruit	Bombay	5 years (1953-58)	0.32	To improve the cultivation of *ber* fruit by top-working		do.
Improvement of *ber* fruit	Vindhya Pradesh	7 years (1952-59)	0.32	do.	Final report awaited	
Improvement of *ber* fruit	Pepsu	6 years (1953-59)	0.32	do.		do.
Improvement of *ber* fruit	Rajasthan	5 years (1953-58)	0.32	do.		do.
Improvement of *ber* fruit	Madhya Pradesh	6 years (1953-59)	0.29	do.		do.
Improvement of *ber* fruit trees	Pepsu	4 years (1955-59)	1.41	To carry out varietal and manurial trials on plain and hill fruits		Scheme not started
Control of serious diseases of guava	Rajasthan	3 years (1955-58)	0.31	To identify and to find out control measures of diseases of guava		do.
Establishment of fruit research stations in the plains	Uttar Pradesh	11 years (1949-60)	0.97	To evolve better and high yielding varieties of fruits especially citrus and mango		do.

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Fruit preservation	Assam	5 years (1950-55)	0.10	To impart training in fruit and vegetable preservation especially to ladies	A number of persons have been trained in fruit preservation	
Fruit preservation	Hyderabad	3 years (1957-60)	0.06	do.		Scheme current
Fruit preservation	W. Bengal	3 years (1957-60)	0.06	do.		Scheme not yet started
Mycological and entomological investigations of fruits	Uttar Pradesh	5 years (1950-55)	2.37	To investigate the causes and remedial measures of diseases and insect pests of tropical and sub-tropical fruits	Final report awaited	
Horticultural investigations	Uttar Pradesh	8 years (1947-55)	1.04	To evolve better varieties of temperate fruits	Final report awaited	
Research on pests of vegetables and fruit trees	Punjab	3 years (1956-59)	0.52	To find out control measures of important pests of fruits and vegetables		Scheme current
Cytogenetic studies in relation to floriculture	I.A.R.I.	3 years (1957-60)	0.87	To improve and evolve new varieties of flowers and ornamental plants		do.
Cultivation of lotus	Uttar Pradesh	3 years (1957-60)	0.35	To evolve improved varieties of lotus		do.
Research and development of floriculture	Punjab	3 years (1957-60)	0.35	Introduction and trials of exotic and indigenous varieties of flowers and ornamental plants		do.
Tuber crops	Bombay	5 years (1949-54)	0.74	Improvement of tuber crops and finding out suitable cultural and manurial practices	B-4004 was found to be superior to all the other varieties	
Tuber crops	Bihar	9 years (1950-59)		do.	V. 35 proved to be heaviest yielder	do.
Tuber crops	Orissa	3 years (1954-57)	0.58	do.	Travancore White was found to be the best variety	

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Control of serious diseases of guava	Rajasthan	3 years (1955-58)	0.31	To identify and to find out control measures of diseases of guava		do.
Establishment of fruit research stations in the plains	Uttar Pradesh	11 years (1949-60)	0.97	To evolve better and high yielding varieties of fruits especially citrus and mango		do.

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

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Cultivation of lotus	Uttar Pradesh	3 years (1957-60)	0.35	To evolve improved varieties of lotus		do.
Research and development of floriculture	Punjab	3 years (1957-60)	0.35	Introduction and trials of exotic and indigenous varieties of flowers and ornamental plants		do.
Tuber crops	Bombay	5 years (1949-54)	0.74	Improvement of tuber crops and finding out suitable cultural and manurial practices	B-4004 was found to be superior to all the other varieties	
Tuber crops	Bihar	9 years (1950-59)		do.	V. 35 proved to be heaviest yielder	do.
Tuber crops	Orissa	3 years (1954-57)	0.58	do.	Travancore White was found to be the best variety	

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the sheme	State, University, etc.	Period	Amount of grant sanction-ed (Rs. in lakhs)	Objectives	Achievements	Remarks
Tuber crops	Mysore	5 years (1951-56)	0.20	Improvement of tuber crops and finding out suitable cultural and manurial practices	B.240 and B.5999 proved heaviest yielders	
Tuber crops	Madras	9 years (1950-59)	1.38	do.		Scheme current
Tuber crops and related plants	Travancore University	3 years (1955-58)	0.19	do.		do.
Tuber crops	Andhra Pradesh	3 years (1953-56)	0.13	do.		
Tapioca and sweet potato	Kerala	9 years (1953-62)	4.63	do.		do.
Pests of vegetables	Andhra Pradesh	2 years (1956-58)	0.34	To undertake insecticidal trials and establish a chemical method for the control of pests		do.
Improvement of vegetables	Bombay	11 years (1949-60)	1.99	Varietal improvement, multiplication of pure seeds, control of pests and diseases and survey of cultural practices		do.
Improvement of vegetables	Uttar Pradesh	11 years (1949-60)	2.75	do.		do.
Improvement of vegetables	Pepsu	6 years (1952-58)	0.89	do.		do.
Improvement of vegetables	Madras	5 years (1954-59)	1.46	do.		do.
Improvement of vegetables	Kashmir	6 years (1953-59)	1.11	do.		do.
Improvement of vegetables	Punjab	5 years (1953-58)	0.72	do.		do.

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Improvement of vegetables	Hyderabad	7 years (1953-60)	1.10	Varietal improvement, multiplication of pure seeds, control of pests and diseases and survey of cultural practices		Scheme current
Improvement of vegetables	Madhya Pradesh	5 years (1954-59)	1.09			do.
Improvement of vegetables	Vindhya Pradesh	6 years (1953-59)	0.97	do.		do.
Improvement of vegetables	Himachal Pradesh	6 years (1953-59)	0.82	do.		do.
Improvement of vegetables	W. Bengal	5 years (1953-58)	0.98	do.		do.
Improvement of vegetables	Orissa	5 years (1953-58)	1.32	do.		do.
			ANIMAL HUSBANDRY SCHEMES			
Purchase of cattle films	I.C.A.R	1 year (1938-39)	0.02	Cattle breeding propaganda	Films purchased and utilised	
Training in animal genetics	I.C.A.R	1 year (1938)	0.10	To develop research on animal genetics in India	The officer was trained and employed	
Monograph on the anatomy of cattle	I.C.A.R	3½ years (1941-45)	0.15	To prepare a monograph for the use of research workers and students	The monograph was prepared	
Defining breed characteristics of Hariana Sahiwal cattle	Punjab	2 years (1939-41)	0.01	To guide selection in breeding and establish herd books for the breeds	Breed definitions of Hariana and Sahiwal cattle published	
Defiining breed characteristics of Kankrej cattle	Bombay	2 years (1939-41)	0.01	do.	Breed definitions of Kankrej cattle published	
Defining breed characteristics of Dangi and Nimari cattle	Bombay	1 year (1952-53)	0.03	do.	Breed definitions prepared	
Defining breed characteristics of grey breeds	I.V.R.I	—	0.21	do.	Draft definitions of Bachaur Kherigarh, Nagaur, Malvi, Rath, Gaola and Kankatha breeds of cattle prepared	

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Defining breed characteristics of Amritmahal and Halikar cattle	Mysore	—	0.03	To guide selection in breeding and estalish herd books for the breeds	Definition prepared	
Defining breed characteristics of Berari buffaloes	Madhya Pradesh	1 year (1953-54)	0.02	do.	Draft definition prepared	
Cattle improvement	Madras	1½ year (1944-45)	0.10	To improve local cattle by adopting scientific breeding practices, promote maintenance of records and registration in herd books	Improvement effected and animals registered. From the experience gained through these and the milk recording schemes the comprehensive Key Village Scheme was formulated	
Cattle improvement	Baroda	3 years (1946-49)	0.08			
Cattle improvement	Punjab	6 years (1941-47)	0.43			
Cattle improvement	Travancore	4 years (1945-49)	0.09			
Cattle improvement	Ajmer	2 years (1944-46)	0.09			
Cattle improvement	Bombay	6 years (1943-49)	0.16			
Cattle improvement	Uttar Pradesh	11½ years (1939-50)	0.21	do.	do.	
Cattle improvement	Sindh	6 years (1931-46)	0.50			
Central Herd Book Section	I.C.A.R.	15 years (1931-46)	1.20	To establish herd book for important breeds of cattle and buffaloes	Herd books were established for Murrah buffaloes and Sindhi, Sahiwal, Hariana, Tharparkar, Gir, Kankrej, Ongole and Kangayam cattle	
Expansion of Central Herd Book Section	I.C.A.R	3 years (1955-58)	1.74	To expand the activities of Herd Book Section	Section expanded	Scheme current
Milk recording	Madras	1½ years (1940-41)	0.002	To develop milk strain of cattle	On the basis of experience gained through these schemes, and cattle improvement schemes, the Key Village Scheme was drawn up	
Milk recording	Punjab	3 years (1939-42)	0.03			
Milk recording	Bombay	10 years (1939-49)	0.02			

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Salvage of dry cows from cities	I.C.A.R.	1 year (1941-42)	0.01	To salvage useful dry cows from cities to prevent their slaughter	The Committee appointed for the purpose made recommendations for the purpose	
Artificial insemination	I.V.R.I.	3 years (1943-46)	0.75	To study the applicability of known techniques under Indian conditions	The known techniques were found to be suitable under Indian conditions	
Methods of yoking bullocks	Uttar Pradesh	5 years (1943-48)	0.18	To try different types of yokes for suitability and study relationship between body conformation and draught ability	Yokes allowing maximum side movement were found to be more suitable. No definite relationship was found between draught ability and body conformation	
Evolving suitable draught capacity measures for bullocks	I.V.R.I.	11 years (1949-60)	2.05	To evolve methods for measuring the draught capacity and utilise the same for selection in draught breeds	—	Scheme current
Using milking cows for work	Mysore	—	0.01	To study the effect of work on milking capacity of Hallikar cows	The scheme terminated prematurely	The scheme ran for only 3 months
Using milking cows for work	Punjab	—		To study the effect of work on milking capacity of Hariana cows	It was observed that work had no adverse effect on milk production	
Using milking cows for work	I.D.R.I.	—	0.45	To study the effect of work on milking capacity of Sindhi cows	do.	
Physiological genetics of cattle	W. Bengal	4 years (1955-58)	2.37	To study the adoptability of Gir, Hariana, Tharparkar, Sahiwal and Sindhi cattle under hot humid climates of West Bengal	Work in progress	Schemes current
Cattle breeding research	Himachal Pradesh	5 years (1957-62)		To compare selective breeding of local cattle against grading up with Sindhi Afghan breed		do.
Immunogenetics of Indian cattle	I.V.R.I.	3years (1955-58)	0.60	To study breed differences amongst important breeds, and determine the inheritance of cellular antigen	—	do.

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Fundamental study of quantitative inheritance	I.V.R.I.	3 years (1956-59)	0.97	To conduct fundamental research on quantitative genetics and conduct large scale experiments in selection using metric standards		Scheme current
Central Artificial Insemination Centre	N.D.R.I.	3 years	2.00	To collect and distribute Jersey semen for field cross breeding units	11,422 c.c. of Jersey semen distributed up to 31-3-1956	
Manual on preparation of animals for Indian markets	I.C.A.R.	1 year	0.05	To prepare a manual for the guidance of breeders		
Comparative study of selective breeding of local cattle and grading up with improved breeds	Bihar	4 years (1955-59)	1.52	To study economics of selective breeding as compared with grading up with improved breeds	—	do.
Selected breeding and grading up of cattle	Orissa	4 years (1955-59)	1.38	do.	—	do.
Selected breeding and grading up of cattle	W. Bengal	3 years (1955-58)	1.61	do.	—	do.
Selected breeding and grading up of cattle	Madras	3 years (1957-60)	0.86	do.	—	do.
Selective breeding vs. grading up of Marthawada buffaloes	Andhra Pradesh	2 years (1958-59)	2.06	do.	—	do.
Comparative value of selective breeding and cross breeding	Kerala	3 years (1957-60)	1.15	To study economics of selective breeding as compared with cross breeding	—	do.
Livestock investigation	Punjab	18 years (1941-59)	1.98	To evolve dual purpose Hariana cattle by combining the economic characters, i.e. draught ability and milking capacity	A dual purpose Hariana has been evolved	Scheme to be taken over by State Govt.
Improvement of Kangayam breed	Madras	17 years (1942-59)	5.63	To improve milking capacity of Kangayam cows without adversely affecting draught capacity of the breed	Improvement has been affected	do.

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Cattle Improvement Insurance Scheme	Pepsu	5 years (1949-54)	0.92	To study the influence of marketing and insurance on cattle development	Data has been collected; results not encouraging	
Cross-breeding of cattle	Andhra Pradesh	4 years (1955-59)	0.76	To investigate the potentialities of cross-breeding in hilly and heavy rainfall areas and to ascertain the optimum proportion of foreign blood to obtain best results	Work in progress	Scheme current
Cross-breeding of cattle	Assam	4 years (1955-59)	0.63			
Cross-breeding of cattle	Bihar	4 years (1955-59)	0.79			
Cross-breeding of cattle	Madras	4 years (1955-59)	0.77			
Cross-breeding of cattle	Kerala	4 years (1955-59)	0.55			
Cross-breeding of cattle	Kerala	5 years (1956-61)	0.52			
Cross-breeding of cattle	Uttar Pradesh	2 years (1957-59)	0.54			
Cross-breeding of cattle	W. Bengal	3 years (1956-59)	0.68			
Cross-breeding of cattle	Manipur	2 years (1955-57)	0.37			
Cross-breeding of cattle	Punjab	5 years (1955-60)	0.86			
Metabolic effects of hormones	Uttar Pradesh	3 years (1955-58)	0.16	(*a*) To induce lactation in uneconomic cows (*b*) Cause sterility with use of cervix spring	Lactations have been induced. The procedure was effective in high yielding cows only	do.
Sterilisation of scrub cows	I.V.R.I.	3 years (1956-59)	0.51	To evolve method for sterilisation of cows	—	do.
To study thickness of skin and distribution of sweat glands of buffaloes	I.V.R.I.	3 years (1957-60)	0.37	To determine relationship between skin histology and milk yield in buffaloes	—	do.
Using milch cows for work	I.V.R.I.	5 years (1952-57)	0.23	To compare the value of Hariana cows when used for work, milk and breeding with cows of other breeds	Data is being collected	

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Manufacture of ghee	I.D.R.I.	3 years (1943-46)	0.14	To study different methods of ghee manufacture	Ghee prepared without souring milk kept longer and retained Vitamine 'A'.	
Standardisation of techniques of manufacture of ghee	I.D.R.I.			To evolve technique to produce ghee of better keeping quality	Pre-stratification gave ghee of better initial keeping quality	
Detecting adulteration in ghee	I.D.R.I.	6 months (1944)	0.02	To evolve tests to detect adulteration	Tests evolved to detect adulteration up to 10%	
Linoleic acid content of ghee	I.I.Sc.	1 year (1947-48)	0.05	To evolve tests to detect adulteration	Genuine ghee did not contain more than 2% linoleic acid.	
Glycaride structure of ghee	I.I.Sc.	1 year (1949-50)	0.12		By acetone alcohal solubility test the addition of animal fats in ghee could be detected, but the animals fed on cotton seed also gave positive reaction	
Flourescene analysis of ghee	I.I.Sc.	1 year (1949-50)	0.03		Changes brought about by rancidity or adulteration could not be detected spectrophotometrically	
Developing ghee industry	Madhya Pradesh	5 years (1943-48)	0.23	To increase production of ghee in Jhaller tract	Objects were achieved. The work was taken over by State Government	
Preventing high acidity in ghee	I.D.R.I.	3 years (1943-46)	0.80	To improve keeping quality of ghee	A process for removing high acidity evolved	
Colouring *vanaspati* with "*ratanjot*"				To detect adulteration of ghee with *vanaspati*	Addition of *ratanjot* and sesame oil to all *vanaspati* recommended	
Finding substitute for tinned steel milk containers				To economise in the use of steel	Tinned steel and tinned bronze containers were considered best	
Grading yellow ghee				To regulate trade in yellow ghee produced in Saurashtra	Standards for regulating trade in yellow ghee specified	

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Transport of milk from villages to towns				To study production, handling and distribution of milk by Co-operative Unions and suggest ways to improve keeping quality	Recommendations covering the entire field made	
Preparation of vegetable rennet from withania coagulance				To prepare vegetable rennet for use in cheese making	Use of gummy pulp extract in soft cheese-making gave encouraging results	
Investigating chemical and nutritive qualities of vegetable oils	I.D.R.I.	1$\frac{1}{2}$ year	0.25	To compare the nutritive value of vegetable oils with ghee	No significant difference observed	
Determining nutritive value of *vanaspati*	I.V.R.I.	4 years (1944-50)	0.95	To compare nutritive value of ghee with hydrogenated vegetable oils	Laboratory animals fed on *vanaspati* required more vitamin and minerals	
Evolving methods for manufacture of casein	I.D.R.I.	1 year (1945-46)	0.06	To evolve methods of manufacture of casein in India	Casein manufactured on laboratory scale	
Purifying vegetable rennets	I.D.R.I.	1 year (1948-49)	0.07	To purify vegetable rennets for manufacture of cheese	Purified rennet comparable with imported product prepared	
Biochemical research on *dahi*		5 years (1944-49)	0.46	To study composition of and distribution of organisms in *dahi*	Standard conditions required for producing high quality *dahi* laid down	
Hay box methods of heating milk				To study efficiency and effects on bye-products	Method economical but efficiency to preserve milk doubtful	
Dairy sanitizers	N.D.R.I. (Bangalore)	3 years (1955-58)	0.60	To test different cleansing material for their detergent and germicidal efficiency and prepare suitable mixture	Work in progress	Scheme current
Bacteriological quality of milk	Bombay	5 years (1955-60)	1.46	To survey the bacteriological quality of milk produced and to evolve methods for improving, keeping quality	Work in progress	do.

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Bacteriological quality of milk in Delhi	N.D.R.I.	3 years (1956-59)	1.15			Scheme current
Bacteriological quality of milk in Delhi	Agricultural Institute, Allahabad	3 years (1957-60)	1.08			do.
Utilisation of bye products of Indian dairy industry	N.D.R.I.	2 years (1955-57)	0.10	To evolve and utilise bye-products of ghee and butter industry and to design equipment suited to cottage industry	Studies with skim milk completed; further work in progress	
Pathogenic bacteria	N.D.R.I.	3 years (1955-58)	0.82	To study whether pasteurisation ensured complete destruction of human pathogenes	Work in progress	
Standardisation of methods for analysis of ghee	N.D.R.I.	1 year (1956-57)	0.12	To detect adulteration by correlating the values of different analytical tests	Work conducted at 8 centres	do.
Quality improvement in milk and milk products	Uttar Pradesh	3 years (1947-50)	0.12	To improve the quality of milk and work out economics causing such improvement	Data collected	
Heat resistant flora in milk	I.D.R.I.	3 years (1951-54)	0.82	To find out the heat resistant flora and devise ways to improve keeping quality	Heat resistant flora determined	
Detection of adulteration of milk	Punjab University	3 years (1955-58)	0.11	To evolve methods for detecting adulteration	—	
Manual on dairying in India	I.C.A.R.	—	0.04	To prepare a manual for use of research workers and students	Manual prepared and published	
Rapid determination of fats, etc. of milk	W. Bengal	4 years (1951-55)	0.28	To determine constituents of milk and fix legal standard	Data on constituents of milk collected	do.
-do-	Punjab	3 years (1949-52)	0.33	do.		

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	objectives	Achievements	Remarks
Central Dairy Information Bureau	I.C.A.R.	5 years (1956-61)	1.02	To disseminate information on dairying	—	Scheme current
Introduction of sterilised milk in India	W. Bengal	3 years (1956-59)	1.84	To study production and marketing of sterilised milk in India	Not started as yet	do.
Standard methods for analysis of milk and milk products	I.D.R.I.	3 years (1949-52)	0.40	To standardise methods of analysis	Methods standardised	
Standard methods for analysis of milk and milk products	Bihar	3 years (1949-52)	0.42			
Bacteriological tests of milk	W. Bengal	3 years (1956-59)	0.27	To evolve platform tests to determine bacteriological quality of milk	Not started as yet	do.
Accelerated oxidation test of ghee	I.D.R.I.	3 years (1955-58)	0.78	To test the quality of ghee	—	do.
Let down response of Indian cow	W. Bengal	3 years (1956-59)	0.25	To study let down of milk under various systems of milking	Not started as yet	do.
Indian Dairy Year Book	I.C.A.R.	1 year (1957-58)	0.27	To compile and publish available information on dairying in the form of an year book	—	do.
Sheep breeding	Orissa	4 years (1946-50)	0.21	To improve indigenous sheep by grading with Bikaneri	Definite improvement in colour and length of wool fibre achieved	
Sheep breeding	Bihar	6½ years (1942-48)	0.26	To improve local sheep through selective breeding	Improvement could not be effected	
Survey of sheep	Rajasthan	1 year (1949-50)	0.02	To survey the various types of sheep	3 main types along with 8 sub-types described	
Shearing and grading of wool produced in the villages	N.W.F.P.	3 years (1943-46)	0.07	To develop co-operative marketing	Advantages of washing and grading were demonstrated	

RESERCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Sheep breeding	Punjab	11½ years (1936-48)	0.50	To evolve sheep with superior wool through selective breeding and crossing with Merino	A new breed named Hissar dale evolved. Selective breeding being continued under another scheme	
Sheep breeding	Bulochistan	6 years (1941-47)	0.27	To improve Harai breed of *dumba*	The flock did not thrive well	
Sheep breeding	Mysore	4 years (1941-45)	0.09	To evolve superior wooled sheep through selective breeding	No appropriate improvement through selective breeding achieved	
Trials with farm bred Bikaneri rams	Punjab	4 years (1945-49)	0.10	To improve village flock by introducing farm bred sheep	Farm bred Bikaneri sheep could be reared under village conditions	
Breeding sheep for Karakul pelts	N.W.F.P.	5 years (1942-47)	0.29	To evolve local type of Karakul rams	The scheme terminated due to partition	
Defining sheep breeds	Rajasthan	1 year (1954)	0.03	To lay down breed characteristics for Rajasthan sheep	Report not received	
Defining sheep breeds	North Gujerat, Bombay	2 years (1956-58)	0.10	To lay down breed characteristics for North Gujerat sheep	—	Scheme current
Soil analysis for sheep breeding	I.A.R.I.	6 months	0.03	To carry out analysis of Banihal soils to improve pastures	Soil has been analysed	
Wool analysis laboratory	Bombay	13 years (1940-53)	1.77	To study Indian wool scientifically in all its aspects	Wool from different States covering several breeds was analysed	do.
Mutton breeds of sheep	Andhra Pradesh	3 years (1956-59)	0.38	To develop mutton breeds of sheep in South India	Not yet started	do.
Mutton breeds of sheep	Mysore	5 years (1956-61)	0.44	To develop mutton breeds of sheep in South India	Not yet started	do.
Mutton breeds of sheep	Bombay	3 years (1956-59)	0.38	To develop mutton breeds of sheep in South India	Not yet started	do.
Mutton breeds of sheep	Madras	3 years (1957-60)	0.025			

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Wool Analysis Laboratory	Bihar	9 years (1949-58)	0.28	To determine the quality of wool produced and utilise results in upgrading programme	Data on wool analysis collected	Scheme current
Sheep and wool improvement on regional basis (Joria Centre)	Bombay	5 years (1953-58)	0.38	To evolve new type of sheep through selective breeding, grading up with Bikaneri, and crossing with imported rams	Improvement being achieved	do.
Sheep and wool improvement on regional basis (Poona Centre)	Bombay	8 years (1952-60)	2.00			
Sheep and wool improvement on regional basis	Jammu & Kashmir	7 years (1952-59)	1.74	do.		do.
Sheep and wool improvement on regional basis	Madras	5 years (1953-58)	0.88	do.		do.
Sheep and wool improvement on regional basis	W. Bengal	3 years (1955-58)	0.19	do.		do.
Sheep and wool improvement on regional basis	Uttar Pradesh	8 years (1952-60)	1.47	do.		do.
Sheep and wool improvement on regional basis	Rajasthan	5 years (1954-59)	0.95	do.		do.
Sheep and wool improvement on regional basis	Mysore	3 years (1955-58)	0.30	do.		do.
Sheep and wool improvement on regional basis	Himachal Pradesh	5 years (1955-60)	1.69	do.		do.
Sheep and wool improvement on regional basis	Bihar	5 years (1953-58)	0.24	do.		do.
Appointment of Liaison Officer (Sheep & Wool)	I.C.A.R.	3 years (1955-58)	0.19	To co-ordinate the working of sheep and goat improvement schemes	Officer appointed	do.
Sheep Research Station	Punjab	5 years (1953-58)	0.50	To conduct fundamental research and systematic improvement of sheep and wool under range conditions	Improvement effected, research being continued	do.

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Animal nutrition	Assam	8 years	1.14	To investigate causes of degeneration of cattle	Some of the aquatic grasses were recommended as hay and hitherto unused pasture grasses as basic roughage for feeding the livestock	—
Animal nutrition	Bombay	11 years (1949-60)	5.22	To undertake research on applied nutrition	Work is in progress	Scheme current
Animal nutrition	I.D.R.I.	4 years (1954-58)	2.84	do.	Methods of sampling and analysis of grasses have been studied	do.
Animal nutrition	W.Bengal	3 years (1954-57)	0.90	do.	Better quality of grasses have been found out and recommended for use	do.
Nutritive value of indigenous grasses and leafy fodders	I.V.R.I.	10 years	2.04	To determine the nutritive value of grasses and leafy fodders	Four varieties of leafy fodders have been recommended for use	—
Animal nutrition	Punjab	3 years (1955-58)	1.02	To investigate animal nutrition problems	Work will be started shortly	do.
Nutritional requirements of buffaloes	Agra	4 years (1955-59)	0.84	To work out the nutritional requirements of buffaloes	Report is awaited	do.
Servey of the deficiency diseases of livestock	W. Bengal	3 years (1956-59)	0.19	To investigate the incidence and causes of deficiency diseases	Report is awaited	do.
Preparation of compendium on animal nutrition	I.C.A.R.	1 year (1956-57)	0.02	To prepare a compendium on animal nutrition	An officer has been deputed for the preparation of the compendium	—
Influence of trace elements on the health and productivity of livestock	I.V.R.I.	6 years (1952-58)	1.63	To find out the incidence of trace element deficiencies	Trace element deficiencies have been detected in certain areas	do.
Studies on food requirements of sheep under range and agricultural conditions	I.V.R.I.	2 years (1956-58)	0.76	To study the feeding practices and the protein, calcium, phosphorus and carotine requirements of sheep	Report is awaited	do.

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Further work on paddy straw	I.V.R.I.	5 years (1955-60)	3.13	To develop methods for the improvement of paddy straw rations	Work is in progress	Scheme current
Utilisation of waste products for feeding cattle	Orissa	11 years (1950-61)	1.95	To study the physiological response of animals fed on waste products and to work out its economics	Work is in progress	do.
Urea as a protein substitute	I.V.R.I.	3 years (1955-58)	1.58	To investigate the utility of urea in meeting the protein requirements of Indian cattle	Report is awaited	do.
Veterinary investigation (cattle)	Assam	16 years	0.98			
Veterinary investigation (cattle)	Kashmir	11 years	0.60			
Veterinary investigation (cattle)	Mysore	3 years (1955-58)	0.33	To investigate the incidence of various diseases of livestock and to devise ways and means for their effective treatment, control and eradication	Various obscure diseases have been investigated and different chaemotherapeutic agents and vaccines have been recommended for their treatment and control	do.
Veterinary investigation (cattle)	W. Bengal	3 years	0.13			
Veterinary investigation (cattle)	Ajmer Merwara	6 years	0.27			
Veterinary investigation (cattle)	Rajasthan	9 years (1950-59)	0.67			
Veterinary investigation (cattle)	Kerala	8 years (1952-60)	0.32			do.
Veterinary investigation (cattle)	Pepsu	5 years (1954-59)	0.26			do.
Veterinary investigation (cattle)	Saurashtra and Kutch	8 years (1952-60)	0.27			do.
Veterinary investigation (sheep and goats)	Bihar	8 years	58.04	To investigate into the diseases of sheep and goats	Etiology of many of the obscure diseases have been brought to light and various drugs and vaccines have been evolved for their treatment and control	do.

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—*(Contd.)*

Name of the scheme	State, University, etc.	Period	Amount of grant sanction-ed (Rs. in lakhs)	Objectives	Achievements	Remarks
Veterinary investigation (sheep and goats)	Orissa	9 years	0.62			
Veterinary investigation (sheep and goats)	Mysore	9 years	0.67			
Veterinary investigation (sheep and goats)	Madras	9 years	70.30			
Veterinary investigation (sheep and goats)	Hyderabad	5 years (1953-58)	0.43			Scheme current
Veterinary investigation (sheep and goats)	W.Bengal	3 years	13.23			
Veterinary investigation (sheep and goats)	Uttar Pradesh	12 years (1948-60)	1.04			do.
A.D.I.O. (Pigs)	Punjab	5 years (1954-59)	0.21	To investigate diseases of pigs	Work not yet started	do.
Sheep and goats diseases	Rajasthan	3 years (1956-59)	0.82	To investigate diseases of of sheep and goats	Report is awaited	do.
Monograph on chaemotherapy of animal trypanosomiasis	I.C.A.R.	..	0.02	To produce an authoritative book on the chaemotherapy of animal trypanosomiasis	Monograph is under prepra-pration	—
Monograph of helminth parasites of the domesticated animals in India	I.V.R.I.	..	0.06	To produce an authoritative book on helminth parasites of the domestic animals	Monograph is under pre-pration	—
Vaccination against foot and mouth disease	I.V.R.I.	11 years	2.08	To evolve suitable vaccine for the control of foot and mouth disease	Vaccine has been evolved	
Rabies research and diagnostic centre	I.V.R.I.	3 years (1956-59)	0.51	To carry out fundamental and applied research on rabies	Report is awaited	do.
Parasitic diseases	Mysore	5 years (1953-58)	1.30	To study the efficacy of systematic administration of Anthetsuinthics in the control of liverfluke disease	12,9,245 animals were dosed, work is in progress	do.
Fluke diseases of bovines	Bombay (now in Mysore)	3 years (1955-58)	0.36	To control nasal granuloma	Report is awaited	do.

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Investigation of infectious abortion	Uttar Pradesh	5 years (1956-61)	1.71	To investigate the incidence of the disease and to evolve suitable methods for its control	Report is awaited	Scheme current
Study of germicidal action of certain well known medicinal plants	W. Bengal	2 years (1956-58)	0.21	To carry out research on the germicidal action of indigenous medicines	Scheme not yet started	do.
Biology and systematics of hill leeches	Delhi University	3 years (1956-59)	0.29	To investigate the life history and ecology of some of the most common forms of hill leeches	Report is awaited	do.
Liverfluke and other parasitic infections of livestock	I.V.R.I.	3 years (1957-60)	0.67	To investigate the parasites affecting livestock in low lying areas	Report is awaited	do.
Control and eradication of stephenofilariasis amongst cattle	Orissa	6 years (1954-60)	0.53	Investigation into the transmission and control of humpsore	Preliminary investigations have been made; work is in progress	do.
Control and eradication of Stephenofilariasis amongst cattle	Assam	3 years (1954-57)	0.38	do.	Not yet started	
Control and eradication of Stephenofilariasis amongst cattle	W. Bengal	5 years (1955-60)	0.56	do.	Report is awaited	do.
Bearing of nutrition on helminthic infections	I.V.R.I.	3 years (1955-58)	0.65	To investigate the effect of different diets on the susceptibility of animals to worm infestations	Preliminary studies have been made. Work is in progress	do.
Bearing of nutrition on helminthic infections	Lucknow University	16 years	1.33	do.		
Helminth parasites	I.V.R.I.	13 years	1.41	To investigate the life history of helminth parasites and to devise ways and means for their control	Life history of some of the common helminths has been worked out. Copper sulphate and potassium permengnate were found to be highly lethal to Miracidia	
Damage caused by ticks and warble flies	I.V.R.I.		2.36	To evolve suitable measures for the treatment and control of ticks	Coopertox livestock emulsion, Tic Kil and Tick Powder were found to be harmless and quite effective	

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—*(Contd.)*

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Indigenous drugs of India for use in veterinary practice	I.V.R.I.	1 year (1957)	0.07	To promote research on indigenous drugs	Not yet started	
Diseases caused by anaerobes	I.V.R.I.	(1944)	1.24	To carry out applied and fundamental research on diseases caused by anaerobes	Four strains of *Cl. welchii* were isolated and typed. Majority of the strains isolated from clinical cases of black quarter proved to be *Cl. chauvoei*. Alum precipitated vaccines demonstrated satisfactory immunity	
Tuberculin testing	Bihar	..	0.49			
Control of brucellosis	Madras	3 years (1956-59)	1.07	To evolve effective control measures	Not yet started	Scheme current
Control of brucellosis	Orissa	3 years (1956-59)	0.41	do.	do.	do.
Control of bovine pleuro-pneumonia	Assam	9 years (1951-60)	4.64	To evolve suitable methods for its control and eradication	Suitable vaccine has been evolved and the disease has been brought under control in many parts of the State	do.
Investigation of mastitis	Mysore	6 years (1950-56)	0.44	To elucidate the etiology and find out suitable remedial measures	Incidence of the disease has been worked out and causal organisms have been identified and typed. Some of the chaemotherapeutic agents have been tried for treatment and control	
Investigation of mastitis	Bombay	9 years (1950-59)	0.89	do.		do.
Investigation of mastitis	I.V.R.I.	6 years (1952-58)	0.55	do.		
Investigation of mastitis	Panjab	3 years (1956-59)	0.29	do.		do.
Investigation of mastitis	Madras		0.47	do.		
Iuvestigation of mastitis	Uttar Pradesh	3 years (1956-59)	0.31	do.		do.

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Use of lapanised virus against rinder-pest	I.V.R.I.	3 years (1951-54)	0.57	To study the suitability of the lapanised rinderpest vaccine as an immunising agent	Number of animals were vaccinated and the vaccine was found to be harmless and quite effective	
Lumber paralysis in goats	Orissa	3 years (1955-58)	0.47	To investigate the aetiology of the disease in Beetal goats	Report is awaited	Scheme current
Lumber paralysis in sheep and goats	Punjab	3 years (1956-59)	0.27	do.	Report is awaited	do.
Contagious caprine pleuro-pneumonia	I.V.R.I.	3 years (1953-56)	0.20	To ascertain incidence of the disease and to evolve suitable vaccines for its controls	Survey has been made and vaccinations have been done in selected farms. Field outbreaks of the disease were checked with Longley's formalised vaccine	
Consideration of the recommendations of the Sub-Committee of Indigenous drugs	I.C.A.R.		0.21	To implement the recommendations of the Sub-Committee	—	Not yet started
Life history and bionomics of goat warble fly in India	I.V.R.I.	3 years (1953-56)	0.30	To work out the life history of goat warble fly and to devise ways and means for its treatment and control	Distribution and seasonal occurance of *H. crossii* has been studied and its life history has been worked out. Coopertox livestock emulsion has given good results	
Coccidial flora of cattle	Bombay	3 years (1957-60)	0.40	To investigate into the incidence of farm coccidia	—	Not yet started
Manufacture of virus vaccine	Madras	2 years (1956-58)	0.24	To improve the present sheep-pox vaccine	Report is awaited	Scheme current
Improvement of vaccine	Madras	2 years (1955-57)	0.21	To improve the present H.S. and B.O. vaccines	Report is awaited	
Bacterial flora of bovine genitalia	Orissa	3 years (1955-58)	0.28	To find out the type of organisms normally inhabiting the cattle genitalia	Report is awaited	do.
Fascioliasis in ruminants	Hyderabad	5 years (1956-61)	1.73	To evolve better methods of treatment and control	—	Not yet started

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Diseases of poultry	Bihar	10 years (1940-50)	0.46	To investigate the diseases of poultry	Aetiology of some other common diseases was established. Drugs were evolved for treatment and control	—
Helminth parasites affecting poultry	I.V.R.I.	—	0.58	To investigate the factors which control the resistance of poultry to helminths	Deficiencies of vitamin A, calcium and protein had no untoward effect on the resistance of poultry to *Heterakis gallinae*	—
Coccidiosis in poultry	I.V.R.I.	3 years (1955-58)	0.23	To determine the relative efficiency of drugs in the treatment and control of the disease	The infective brew of pure strain of *E. tenella* has been raised for the purpose of further investigations	Scheme current
Immunisation of village poultry against Ranikhet disease	Bombay	3 years (1954-57)	0.30	To determine the immunological aspect of Ranikhet disease vaccine	Preliminary studies have been made. The work is in progress	do.
A.D.I.O. Poultry	Andhra Pradesh	3 years (1955-58)	0.24	To investigate the diseases of poultry and institute control measures	Report is awaited	do.
Post-graduate course in parasitology	Madras	3 years (1955-58)	0.26	To train veterinary graduates in the control of parasitic diseases	First batch of six students has been trained	do.
Rural pisiculture	Madras	10 years (1942-52)	1.79	To make a study of the important food fishes with regard to ecological complex governing fish life, disease, mortality, etc.	Studies on growth, food, breeding habits, life histories, fish diseases and mortality of some of the important edible fishes have been completed	
Fishery research scholarship	Travancore-Cochin	3 years	0.09	To promote research on pisiculture	Scholarships were awarded	
Processing of unpopular fish	W. Bengal	4 years (1954-58)	0.24	To investigate the methods of processing of inedible or unpopular fish	The gross analysis of the fish tissue has been completed and quantitative determinations of the amino acid components of the tissues have been made	do.

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Fish fauna and ecology of food fishes	Sagaur University	2 years (1954-56)	0.17	To survey fish fauna of Madhya Pradesh and to study ecology of food fishes	Survey has been completed and most of the fishes collected have been identified	—
Improvement of craft and tackle in fishing	Orissa	2 years (1955-57)	0.52	To effect improvement in the available fishing craft and tackle	Report is awaited	—
Hydro-trological and Fanistic survey of the Godavari Estuarine system	Andhra University	5 years (1954-59)	1.66	To survey the hydro-biological conditions and the fauna of the lower reaches and various estuaries of the Godavari	Report is awaited	Scheme current
Ecology of fresh water fishes in U.P.	Lucknow University	5 years (1954-59)	0.54	To make fundamental studies on the ecology of fish in U.P. in order to step up the total fish yield	Report is awaited	do.
Regional Bee Research Station	Punjab	5 years	0.58	To carry out fundamental research on Indian honey bees and to standardise management practices	High yielding and less swarming strains were evolved and suitable methods for the control of bee-enemies were worked out	do.
Regional Bee Research Station	Madras	7 years (1951-58)	0.85			
Behaviour studies on *Apis indica*	Poona University	—	—		—	(Scheme not started. Funds to be resumed)
Studies on bee flora	Coorg	3 years (1956-59)	0.26	To study bee flora of the State and to assess the quality of honey with special reference to flora	Report is awaited	Scheme current
Appointment of Mr. Kartha for the completion of certain statistics relating to feeding scales, etc. in military dairies	I.C.A.R.	2 years (1932-34)	0.07	To investigate the comparative efficiency of Indian cow, half bred and buffalo as producers of milk and fat	Published in 1934 in "*Agriculture and Livestock in India*"	

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Feeding values of certain food grains, oilseeds and cakes for heifers	Punjab	3 years (1939-42)	0.02	To ascertain the feeding values of certain food grains, oilseeds and oil-cakes	*Taramira* seeds and cake were pungent to taste but are believed to have a cooling effect. *Sarson*, groundnut and *toria* cake were found to be very good	—
Monograph on animal nutrition in India	I.C.A.R.	2 years (1941-43)	0.06	To publish a monograph on animal nutrition	The monograph was published	—
Animal nutrition	Madras	8 years (1935-43)	0.73	To undertake applied research on animal nutrition	Daily requirements of calcium and phosphorus have been worked out. Aphosphorosis played a part in producing the syndrome in combination with the fluorine present in the water. White ragi was found to be superior to brown ragi. Sulphur when fed to sheep was not found to increase the yield of wool	—
Manual of feeding of farm animals	Punjab	2 years (1942-44)	0.02	To produce an authoritative book on feeding of farm animals	The book was published	
Feeding value of indigenous fodder	Bihar	7 years (1937-44)	0.39	To find out the composition of local fodders and the changes in their composition as affected by soil, climate, age, manuring, etc.	Merits and demerits of many commonly fed fodders were established. It was observed that the same fodder growing in different tracts showed considerable variations in composition	—
Drying of grass	Bombay	3 years (1941-44)	0.05	—		
Animal nutrition	Bengal	15 years (1932-47)	1.73	To study the problems of animal nutrition affecting Bengal	Nutritional requirements of cattle were studied and available feed stuffs in suitable combinations have been recommended	—
Feeding value of food grains, oilseeds and oilcakes, to working bulls	Punjab	5 years (1942-47)	0.38	To study the nutritional requirements of milch cows, heifers, and working bullocks	Nutritional requirements were studied and useful combinations for 1 lb. of milk, and for bullock in medium work were arrived at	

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Feeding oilcakes to milch cattle	Baroda	2 years (1944-46)	0.05	To ascertain the good effects of feedings different oilcakes and their economics	The rise in milk yield, etc. was not found to be correlated with any particular type of concentrated feed fed during periods of observation	—
Feeding of cattle on departmental farms	Uttar Pradesh	11 years (1938-49)	1.58	To study the comparative feeding values of available feeds and to evolve economical concentrate mixtures	Economical concentrate mixtures to go with different straws were formulated	—
Feeding alkali-treated cereal straws	I.V.R.I.	5 years (1942-47)	0.11	To improve the feeding value of straw	Alkali treatment considerably improved the nutritive value of coarse fodders. Animals raised on treated straw were found to grow about 67% quicker than the control group	—
Determination of standard rations for ryots cattle	Orissa	2 years (1946-48)	0.12	To try out economics of balanced ration computed economically from locally available feeding stuffs	By feeding balanced rations there was a saving of 31.91% in the cost of feeds and a substantial saving due to significant increase in the milk production	—
Nutritional requirements of milch cows	Punjab	6 years (1941-47)	0.11	To study the nutritional requirements of milch cows	Nutritional requirements of milch cows were ascertained	—
Introduction of balanced rations for ryots cattle	Orissa	—	—	To determine the economics of feeding balanced ration from locally procurable food stuffs	Typical rations computed with the available food stuffs were recommended for different classes of animals	—
Testing of drug plasmoquine	—	2 years (1935-37)	0.01	To study the curative effects of plasmoquine in piroplasmosis	—	Scheme terminated on partition of the country
All India Legislation for the control of animal diseases	I.C.A.R.	1 year (1936-37)		To frame rules and regulations for the control of contagious diseases of animals	An Animal Contagious Diseases Act has come into force. Many of the State Governments have framed rules under this Act	

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Investigation into most suitable and economic methods of combating different types of parasitic infection in ruminants in the field	Punjab	3 years (1934-37)	0.13	To analyse the basal causes of infestation and find suitable economical treatment for each type of parasite	Methods were evolved for practical control of parasitic diseases	—
Investigation regarding vaccination of cattle against rinderpest	Central Provinces	3 years (1935-38)	0.41	To carry out systematic observations and researches on all aspects of goat virus inoculation against rinderpest	1,41,177 heads of cattle were vaccinated with goat vaccine using different methods	—
Study of indigenous veterinary medicines	I.C.A.R.	12 years (1940-52)	0.04	To find out cheap and effective indigenous remedies with a view to replace costly foreign preparations as far as possible	Number of such indigenous drugs have been recommended for trials in the veterinary hospitals	—
A systematic protozoologist	I.V.R.I.	5 years (1936-41)	0.42	To work out the bionomics of the various protozoa which are the cause of serious losses among valuable stock in this country	Life history and bionomics of various protozoan parasites were studied and various chaemotherapeutic agents for their treatment and control were recommended	—
Helminth parasites	Central Provinces	3 years (1940-43)	0.04	To ascertain the incidence of helminthic infection in the State	Various helminth parasites affecting livestock in the State have been identified and their life history and bionomics ascertained	—
Survey of helminth infection	I.V.R.I.	2 years (1940-42)	0.05	To survey the nature and incidence of helminthic infections of sheep, goats, cattle and buffaloes in the States of Northern India	The large number of parasites collected during survey indicated the widespread occurrence of worms in Indian livestock	
Contagious abortion	I.V.R.I.	5 years (1939-44)	1.36	To determine the prevalance and incidence of *Brucella abortis* infection in the country and to devise ways and means for its control and eradication	Ways and means were devised to control the disease. In many parts, the incidence of the disease has been fairly brought under control	—

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Tuberculosis and Johne's disease	I.V.R.I.	—	—	To determine the incidence of T.B. and Johne's disease in Indian livestock and to devise suitable methods for their diagnosis and control	Incidence of these diseases was studied and suitable diagnostic agents were evolved. Different strains of T.B. were isolated and typed	—
Veterinary Investigation Officer	Bengal	18 years (1932-50)	0.88	To investigate the incidence of various diseases of livestock, to establish their aetiology and to devise ways and means for their effective treatment, control and eradication	Various obscure diseases of livestock have been investigated and their causal organisms have been determined and identified. Different chaemotherapeutic agents have been tried for their suitability, economics and effectiveness and some of the newly evolved vaccines have been put to field tests	—
Veterinary Investigation Officer	Punjab	16 years (1932-48)	0.90			
Veterinary Investigation Officer	N.W.F.P.	12 years (1935-47)	0.74			
Veterinary Investigation Officer	Sindh	10 years (1937-47)	0.58			
Veterinary Investigation Officer	Bihar	16 years (1932-48)	1.04			
Veterinary Investigation Officer	Central Provinces	16 years (1932-48)	0.90			
Veterinary Investigation Officer	Hyderabad	16 years (1932-48)	1.03			
Veterinary Investigation Officer	Punjab	3 years (1947-50)	0.19			
Veterinary Investigation Officer	Baroda	3 years (1947-50)	0.12			
Veterinary Investigation Officer	Madras	15 years (1933-48)	1.20			
Veterinary Investigation Officer	Bombay	15 years (1933-48)	1.09			
Veterinary Investigation Officer	Orissa	10 years (1938-48)	0.58			

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Veterinary Investigation Officer	Sind	10 years (1937-47)	0.58	To investigate the incidence of livestock diseases and to establish their etiology with a view to find out suitable measures in respect of their control and treatment	Different vaccines have been tried for the prevention of contagious caprine pleuro-pneumonia and their merits have been established. The existence of Goat dermatitis, a new virus disease resembling goat-pox was identified. New method of rinderpest vaccination by scarification method was evolved.	—
A.D.I.O. (sheep and goats)	Punjab	½ years (1946-47)	0.0006	To investigate into various obscure diseases of sheep and goats in the province	Carbolised vaseline to the pustules and boric lotion to the eyes proved effective in goats suffering from pox. Cold douche over the head and other symptomatic treatment were found to be quite effective for cases suffering from encephalomyelitis	—
A.D.I.O. (sheep and goats)	Bombay	—	—	To determine the incidence of various known and unknown diseases of sheep and goats with a view to control and eradicate them	Some of the obscure diseases were brought to light and suitable drugs were recommended for their treatment	—
Etiology of sheep disease	Bihar	4 years (1942-46)	0.15	To elucidate the etiology of Pitto and Gillar	These diseases were found to be due to amphistomes in the alimentary tract. Treatment with copper sulphate and carbontetrachloride gave good result	—
Etiology of sheep disease	Madras	1 year (1945-46)	0.01	To investigate diseases of sheep and goats	Incidence of various diseases was ascertained. Prophylactic measures including vaccination, etc. were undertaken. Etiology of some of the obscure disease was worked out and ways and means to combat such diseases were recommended	—

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Preparation of rinderpest vaccine	Uttar Pradesh	4 years (1945-49)	.07	To evolve suitable desiccated rinderpest goat spleen tissue vaccine	Non-hygroscopic pills of the size of .5 mm. × 3 mm. were produced which were found to remain potent for 32 days in room temperature. The reaction produced by pills was milder and serum was not necessary. For vaccination a pill injector was also evolved. The immunity conferred was solid and lasting	
Control of warble fly	I.V.R.I.	7 years (1942-49)	0.90	To investigate the incidence and life history of warble fly	Derris powder was found to destroy more larvae as compared to tobaccoline mixture which was found to be quicker in action. Life history of the fly was also studied	—
Control of ticks	Bombay	6 years (1939-45)	0.17	To eradicate tick infestation	Dipping and spraying centres were organised where the animals were regularly treated	
Indigenous drugs used in veterinary medicines	Madras	—	—	—		
Bearing of nutrition on helminthic infestation	I.V.R.I.	4 years (1948-52)	0.55	—	—	
Monograph on rinderpest in India	I.C.A.R.	3 years (1935-38)	0.41	To bring out an authoritative publication on rinderpest	Monograph is under preparation	—
Tuberculin testing of cattle	Punjab Bombay	3 years (1946-49)	0.04	To study the incidence of tuberculosis in the cattle population of the state	Incidence of the disease was ascertained with the help of tuberculin (diagnostic) test	—
Tuberculin testing of cattle	Madras	—	—			
V.I.O. (Cattle)	Punjab	3 years (1947-50)	19.79	—		
V.I.O. (Cattle)	Baroda	3 years (1947-50)	0.12	—		

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
A.D.I.O. (sheep and goats)	Baroda	4 years (1946-50)	0.14	To investigate the extent and incidence of diseases of sheep and goats	Etiology of some of the obscure diseases was established. With the help of mass vaccinations the incidence of diseases was brought under control	—
Helminthiasis	West Bengal	3 years (1947-50)	0.04	To elucidate the life histories and bionomics of some of the common parasitic worms	Morphological characters of some of the important helminths were studied. Some of the proven medicaments were recommended for the control of snails	—
Helminthiasis	Madras	—	—	To elucidate the life histories of certain parasitic worms	Life histories of *Oesophagostomum radiatum*, *Ascaris vitulorum*, *Moniezia Spp. Limnaes* and *Indoplanorbis* were completed, and published. Hostparasite relationships were also studied	—
Johne's disease	Mysore	8 years (1935-43)	0.28	To investigate the incidence of Johne's disease	Sheep and goats were successfully infected with Johne's disease. Disease could also be transmitted to laboratory animals. The Johnin was found to be better than Avian Tuberculin for diagnostic purposes. Chaulmoogra-oil was tried as curative agent without much success. A strain of Johne's bacilli was successfully grown on liquid media	—
Indigenous drugs	Madras	11 years (1940-51)	1.22	To establish the merits and demerits of some of the common indigenous drugs	From the roots of *Acorus calamus* a volatile oil was extracted and its antiseptic and germicidal effects were studied. The toxic effects produced by *Hochuera pusilla* were found to be caused by its local effects on gastro intestinal tract and not due to the alkaloid present in it	
Indigenous drugs	Madras	3 years (1949-52)	0.21			

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
V.I.O. (Cattle)	Madras, Bombay, Orissa					
Monograph on veterinary entomology	I.C.A.R.	1 year (1943-44)	0.02	To produce an authoritative book on animal entomology true to Indian conditions	The monograph is under preparation	—
Central Herd Books Section and training of flayers,	Bengal					
Poultry for table purposes	Punjab	5 years (1937-42)	0.12			
Diseases of poultry	I.V.R.I.	3 years (1941-44)	0.30	To investigate diseases affecting the poultry population	Etiology of some of the diseases, hitherto unknown, was established. New vaccine for the control of Ranikhet diseases and fowl pox were evolved and prophylactic vaccinations were done. By the evolution of preventive vaccines incidence of Ranikhet disease and fowl pox has been fairly brought under control. Several chaemotherapeutic agents were tried and their utility ascertained. With the help of sulphamezathin, the incidence of coccidiosis has been very much controlled	—
Diseases of poultry	Bengal	5 years (1942-47)	0.05			
Poultry diseases	Bombay	9 years (1941-50)	0.20			
Poultry diseases	Uttar Pradesh	8 years (1941-49)	0.14			
Poultry diseases	Orissa	5 years (1945-50)	0.11			
Poultry diseases	Hyderabad	9 years (1941-50)	0.15			
Poultry diseases	Baroda	7 years (1942-49)	0.11			
Poultry diseases	Assam	8 years (1942-50)	0.12			
Poultry diseases	Madras	9 years (1941-50)	0.24			
Poultry diseases	Madhya Pradesh	8 years (1942-50)	0.18			
Poultry diseases	W. Bengal	3 years (1947-50)	0.04			
Poultry diseases	Mysore	—	—			

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Poultry husbandry	Bombay					
Poultry lice	Uttar Pradesh	4 years (1944-48)	0.15	To identify species of lice infesting Indian poultry	Toxonomic studies were made and morphological and other characters were studied. Various chaemotherapeutic agents were recommended for use in controlling these pests	
Improvement of *Deshi* fowls	Baroda	—				
Poultry Research Village Extension	I.V.R.I.	—				
Fresh water fishes development	Calcutta University	1 year (1945-46)	0.002	To work out the life history and bionomics of fresh water fishes of economic importance	Life history and bionomics of *Cirrhina reba*, *Labes bata*, *Barhus chola* and some other common fishes of fresh water were studied	—
Piscicultural research	Anamali University	3 years (1951-54)	0.19	To study the seasonal variations in the pituitary gland of *Cirrhina reba*, (2) estimation of vitamin C and fat in the gonad and liver of *Ophicephalus striatus*, (3) further studies on the age, growth and length weight relationship of *Cirrhina reba*, (4) effect of administration of anterior lobe pituitary harmone on the development of gonad	Seasonal variations in gonads and histology of the pituitary glands of *Ophicephalus* and *Cirrhina reba* have been studied	
Fish preservation	Baroda	2 years (1943-45)	0.02	To evolve and improve on existing methods of curing and other methods of preserving fish	Experiments were conducted mostly on Duck, Tuna, Hilsa and Prawns. It was found that almost all the products kept good for periods ranging from one to eight months	

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Fresh water fishes	W. Bengal	10 years (1936-46)	0.32	To work out the life history, bionomics and development of fresh water fishes of Bengal	Life history and bionomics of some of the common fishes were studied along with their sexual dimorphism, diseases, cannibalism and feeding habits	—
Improvement of preservment fish	W. Bengal	2 years (1944-46)	0.03	To devise ways and means for the improvement of preserved fish industry in Bengal	New methods based on hygienic principles were suggested to the curers for adoption	
Experimentation on the barn type dehyderation plants for fish preservation	Orissa	2 years (1945-47)	0.11	To conduct experiments on the barn type of dehyderating plant for preservation of fish	Kiln drying in the barn type plant shortens the curing time and there is less pronounced cured smell	—
Fish, eggs and larvae	Bombay	3 years (1944-47)	0.06	To study the fish eggs and larvae from Bombay waters and to collect data for future work on special lines	Life history and breeding habits of some of the common fishes available in Bombay and Madras waters were studied and basic data has been collected	—
Investigation of fish eggs and larvae	Madras University	5 years (1944-49)	0.12			
Research on the biology of marine prawns	Madras	2 years (1947-49)	0.05	To study the biology of the marine prawns of commercial importance	Amongst two other, *Peneus indicus* was found to be the most common species of prawns. It was observed that the females are in excess to males and that full grown species occur in all waters but the immature forms were found most in back waters during monsoons. Cold monsoon period, *i.e.* between October-February was found to be the most suitable for breeding season	—
Fisheries research scholarships	Calcutta University	2 years (1948-50)	0.20	To make fundamental research in fishing problems	Four scholarships were awarded	

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Semi-dried prawns	Madras	3 years (1945-48)	0.21	To study the techniques for drying the fish and for their storage	Suitable semi-dried technique for inland prawns were developed and new methods were evolved for prolonging the keeping qualities of the products	—
Punjab Apiculture Scheme	Punjab	1 year (1936-37)	0.02	To make fundamental and applied research on bee keeping	An officer was trained in America	—
Bee-Keeping Station	Punjab	2 years (1945-47)	0.31	To carry out fundamental research on habits and culture of Indian honey bee	High yielding and less swarming strains of *Apis indica* have been developed and detailed study of life and seasonal history of workers done and queens have been made	—
Morphology and biology Indian honey bee	Allahabad University	—	—	To study the morphology and biology of Indian honey bee	Studies were made on the external morphology, intraspecific variations, digestive system, reproductive organs, bee flora, seasonal changes in the bee hives, brood rearing temperature and brood rearing and egg laying rate of the Indian honey bee	—
Study of Angora goat industry in South Africa	I.C.A.R.	2 years (1939-41)	0.13	To investigate the possibility of rearing Angora goats in India	The officer was deputed	—
Angora goat breeding	Punjab	6 years (1941-47)	0.15	To develop mohair industry	Discontinued as Angora goats did not adapt to local conditions	
Goat breeding	Bengal	2 years (1945-47)	0.02	To improve size and milking capacity of black Bengal goats	Conclusive results not achieved	
Goat breeding	Uttar Pradesh	15 years (1931-46)	0.83	To study rearing of goats under farm conditions	Study completed and economics worked out	—

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Goat breeding	Punjab	20 years (1939-59)	0.96	To establish high milk yielding breed of Beetal goats	High milk yield herd evolved	The work is to be taken up by Punjab Government
Goat breeding	Orissa	5 years (1946-51)	0.32	To evolve superior breeds through grading up Black Bengal goats with Beetal	The milk yield was not up to expected standards	—
Angora goat breeding	Uttar Pradesh	8 years (1950-58)	0.50	To evolve a U.P. type of Angora goat	High mohair yielding herd developed but not adopted to local conditions	The herd is to be shifted
Breeding meat and mohair goats	Bombay	3 years (1956-59)	0.48	To evolve new types of goats for production of meat and mohair by crossing with Angora bucks	—	Scheme current
Developing milk yielding strains of goats	Bombay	3 years (1956-59)	1.27	To evolve high milk yielding goats by crossing with Sannen Bucks	—	Work not yet started
Improvement of goats	Kerala	5 years (1951-56)	0.72	To improve Malabar goats and distribute progeny tested bucks	Scheme terminated before completion	—
Developing mutton breeds of goats	W. Bengal	5 years	0.81	To improve the carcass of Black Bengal goats through selective breeding	—	—
Producing poultry for table purposes	Punjab	5 years (1937-42)	0.11	To improve indigenous birds for meat production using, Aril and Chittagong breeds	Improvement in size achieved but fattening these birds was not economical	—
Poultry husbandry	Bombay	10 years (1936-46)	0.59	To study all aspects of poultry husbandry	Various aspects of poultry husbandry studied	—
Improvement of *desi* fowls	Baroda	5 years (1944-49)	0.02	To improve *desi* birds by cross-breeding	Improvement achieved	—
Poultry research	Madhya Pradesh	11 years (1945-56)	1.29	To study various aspects of poultry husbandry and carry out improvement of village flocks	Economics of different types of poultry houses and feeds have been worked out. Subsidiary feeds like mohua refuse and mango seed kernal tried	—

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Poultry research	Travancore-Cochin	8 years (1951-59)	0.65	To study adaptability and economics of White Leghorn, R.I.R. and graded poultry	High egg laying flocks established. Final analysis of results awaited	Scheme current
Climatic influence on performance of improved *desi* fowl	Orissa	5 years (1952-57)	0.16	To study the performance of improved *desi* evolved at I.V.R.I., under climatic conditions of Orissa	The egg laying capacity of improved *desi* bird was not impaired	—
Poultry development	American Arcot Mission	3 years (1955-58)	2.45	To study economics of commercial hatchery under Indian conditions	—	Scheme current
Cross breeding of poultry	Agriculture Institute, Allahabad	5 years (1956-61)	0.58	To conduct fundamental research on cross-breeding and inter-breeding of cross-breds	—	do.
Rearing and distribution of White Leghorn chickens	Y.M.C.A. Martandam	1 year (1957)	0.69	To raise 20,000 White Leghorn chicks for village distribution	Report not received yet	—
Defertilisation of eggs	Travancore-Cochin	8 months (1954)	0.12	To improve keeping quality of eggs	Defertilisation improved keeping quality	—
Defertilisation of eggs	I.V.R.I.	(1958)	0.11			
Egg laying trials	I.V.R.I.	4 years (1955-59)	0.36	To conduct laying trials and inculcate desire amongst breeders to develop high laying strains	—	Scheme current
Duck breeding	I.V.R.I.	3 years (1955-58)	0.66	To investigate large scale rearing of imported ducks without providing water reserviors	—	do.
Duck breeding	Kerala	5 years (1954-59)	0.27	To investigate the possibility of rearing Khaki Campbel ducks		do.
Duck breeding	Bihar	5 years (1950-55)	0.28	To establish a high laying strain of Indian runners and Khaki Campbel	The flock was established	—
Village flaying Scheme	N.W.F.P.	5 years (1942-47)	0.14	To impart training in improved methods of flaying	4 master flayers and 140 flayers trained	—

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in Lakhs)	Objectives	Achievements	Remarks
Defects caused to hides by minor biological factors	I.V.R.I.	4 years (1945-49)	0.13	To survey the damage caused by factors other than warble fly and suggest control measures	Survey completed, preventive measures evolved	—
Training of flayers	W. Bengal	1 year (1948-49)	0.09	To impart training in flaying	Flayers trained	—
Manufacture of chrome retan	C.L.R.I.	5 years (1954-59)	0.41	To evolve methods for preparing chrome retan from cow-hides for manufacture of army boots	Commercial process for chrome retaning worked out. Further experiments in progress	Scheme current
Manufacture of fat liquors for leather production	C.L.R.I	6 years (1954-60)	0.50	To manufacture fat liquors from indigenous raw material	Two processes evolved and are offered for commercial exploitation	do.
Manufacture of leather boards	C.L.R.I	6 years (1954-60)	0.43	To manufacture better boards from tannery waste material	Leather boards manufactured. Further experiments being conducted	do.
Chemistry of mineral tannage	C.L.R.I	6 years (1954-60)	1.20	To improve the quality of shoe upper and industrial leather through mineral tannage	Glycerol reduced chrome liquors prepared. Further experiments in progress	do.
Camel survey	I.C.A.R.	2 years (1954-56)	0.56	To conduct survey of camel population, classify different types and study their economic importance	On the basis of survey, a scheme for improvement has been drawn for operation in Rajasthan	—
Development of camels	Rajasthan	5 years (1957-62)	3.73	To improve camels through the establishment of camel farm and Key Village Centre	Work not started as yet	do.
Revision of monograph 'Fungi of India'	I.C.A.R.	—	0.01	To revise the original monograph by E.J. Butler and G.R. Bisby	Under print	do.
Preparation of a monograph on the 'Fungi of India'	I.C.A.R.	—	0.02	To bring out a comprehensive publication on 'Fungi of India based on the original monograph of E.J. Butler	do.	—

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs.)	Objectives	Achievements	Remarks
Monograph "Agriculture in Ancient India"	I.C.A.R	—	25,000	To publish monograph containing complete information on different aspects of agriculture	Under preparation	—
Monograph on rice breeding and genetics	I.C.A.R	—	10,000	To serve as a reference book for the students of agricultural science and research workers	Published in 1953	—
Monograph on helminth parasites of domesticated animals	I.C.A.R	—	6,000	To bring up-to-date the old monograph on the subject	Under preparation	
Printing of Handbook of Statistical methods for agricultural workers	I.C.A.R	—	36,000	To serve as a text book for students of agriculture	Ist edition printed and sold out. 2nd edition under prin	
Publication of Abstracts in I.J.V.S. & A.H.	I.C.A.R	—	5,000	To publish abstracts of article from foreign and Indian Vetrinary Journals .	Printed quarterly in I.J.V.S. and A.H.	
Printing of album of Indian agriculture and animal husbandry	I.C.A.R	—	15,000	Dissemination of information relating to agriculture and animal husbandry through illustrations	Printed in 1955	
Manual on animal nutrition in India	I.C.A.R	(1941-42) (1942-43)	6,530	To prepare a review of researches done in India on animal husbandry	Printed in 1953	
Manual on dairying in India	I.C.A.R	—	4,200	To serve as a text book for the Universities	Printed in 1951	
Monograph on poisonous plants of India	I.C.A.R	(1956-57) (1957-58)	16,12 0	To serve as a reference book to scientific workers and to students of Botany, Pharmacology, chemistry, etc.	Ist volume printed and 2nd under preparation	
Monograph on chaemotherapy of animal trypanosomiasis	I.C.A.R	—	2,000	To present a critical review of the existing information on the subject	Under print	
Revision of the monograph "Anatomy of Ox"	I.C.A.R	—	10,300	To revise the mansucript of the monograph "Anatomy of Ox" which was prepared earlier	Revision completed	

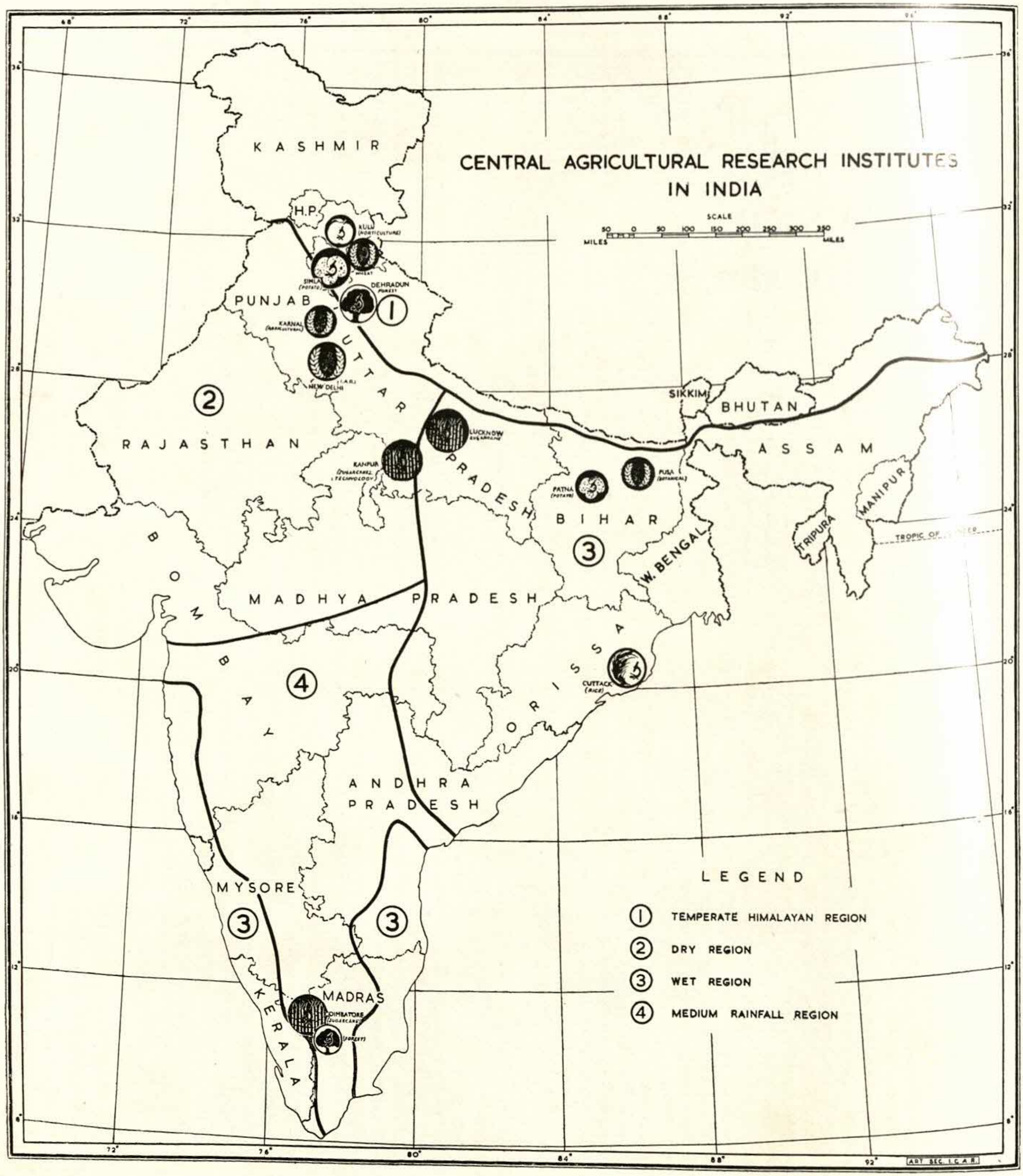
RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs.)	Objectives	Achievements	Remarks
Revision of the manual "Feeding of Farm Animals"	I.C.A.R.	—	1,800	To serve as a reference book for research workers, teachers and students	Under preparation. To be published under the name "Newer knowledge of Animal Husbandry	
Printing of small digests of important publications of the Council	I.C.A.R.	—	15,000	To give the layman some idea of the scope and contents of highly technical research publications	Several Digests have been published	
Printing of the monograph "Veterinary Entomology and Acarology for India	.C.A.R.	—	19,800	To serve as a reference book to scientific workers	Under print	
Printing of Research and Review Series pamphlets	I.C.A.R.	Standing charge	2,55,000	To publish results of research work in A.H. and Agri. subjects	A number of pamphlets have been published	
Abstracts of Horticultural literature	I.C.A.R.	,,	1,31,590	To prepare abstracts from horticultural literature	Published monthly	
Subsidies to various journals	I.C.A.R.	,,	1,31,000	To subsidise the various scientific societies to publish journals on Agri. and A.H. subjects	Subsidies have been given to a number of societies	
Preparation of monographs on algae	I.C.A.R.	—	2,95,800	To publish an up-to-date record of the research work done on algae in India	Under preparation	
Revision of the monograph on potatoes	I.C.A.R.	—	15,900		Under preparation	
Monograph on agricultural meteorology	I.C.A.R.	—	12,000	To serve as a reference and text book on agricultural meteorology	Manuscript received	
Preparation of monographs on different cereal crops	I.C.A.R.	—	7,000	To publish an up-to-date record of research work done on cereal crops in India	Different groups have been allocated to various authors	
Monographs on different groups of fungi and the diseases of various crops	I.C.A.R.	—	3,00,000	To publish an up-to-date record of the research work done on fungi in India	Under preparation	

RESEARCH SCHEMES FINANCED BY THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs.)	Objectives	Achievements	Remarks
Publication of a book 'Agricultural Research in India-Organisation and Institutes'	I.C.A.R.	—	35,000	To publish an account of the organisation and work of various Research Institutes and Commodity Committees	Under preparation	
Monograph on survey of hill sheep in U.P.	I.C.A.R.	—	1,000	To prepare a monograph on the subject	Manuscript prepared	
Printing of a monograph 'Grassland and Fodder Resources of India'	I.C.A.R.	—	12,000	To publish a record of the fodder resources of India	Under print	
Preparation of books on flowering shrubs, flowering creepers and flowering annuals	.C.A.R.	—	92,000	To publish an account of various flowering shrubs, creepers and annuals	Under preparation	
Preparation of an album of medicinal plants	.C.A.R.	—	50,200	To prepare an illustrated album of medicinal plants	Under preparation	
Preparation of a Handbook on Indian Gramineae	I.C.A.R.	—	3,000	To publish a book on Indian grasses	First Vol. of book approved for publication	
Spanish translation of the book entitled "Statistical method for Agricultural Workers"	I.C.A.R.	—	3,000	To publish Spanish translation of the book	Under print	

CENTRAL
RESEARCH
INSTITUTES


CENTRAL AGRICULTURAL RESEARCH INSTITUTES IN INDIA
SCALE
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MILES
MILES
KASHMIR
H.P.
KULU (HORTICULTURE)
WHEAT
SIMLA (POTATO)
DEHRADUN FOREST
PUNJAB
KARNAL (AGRICULTURAL)
NEW DELHI (I.A.R.I.)
UTTAR PRADESH
RAJASTHAN
LUCKNOW SUGARCANE
KANPUR (SUGARCANE TECHNOLOGY)
PATNA (POTATO)
PUSA (BOTANICAL)
BIHAR
SIKKIM
BHUTAN
ASSAM
MANIPUR
TRIPURA
TROPIC OF CANCER
W. BENGAL
BOMBAY
MADHYA PRADESH
ORISSA
CUTTACK (RICE)
ANDHRA PRADESH
MYSORE
MADRAS
COIMBATORE (SUGARCANE)
(FOREST)
KERALA
①
②
③
④
LEGEND
① TEMPERATE HIMALAYAN REGION
② DRY REGION
③ WET REGION
④ MEDIUM RAINFALL REGION
68°
72°
76°
80°
84°
88°
92°
96°
36°
32°
28°
24°
20°
16°
12°
8°
ART SEC. I.C.A.R.

INDIAN AGRICULTURAL RESEARCH INSTITUTE

New Delhi

THE Indian Agricultural Research Institute, also popularly known as the Pusa Institute, is located in a beautifully laid-out colony, covering about 1000 acres, about 5 miles west of the New Delhi Railway Station. The latitude is 28·4°N, the longitude 77·10°E and the elevation above mean sea level 750·046 ft. The maximum and minimum temperatures during the year range between 52·6°F and 116·0°F, and 30·0°F and 91·8°F respectively. The average annual rainfall is 23·22 inches, of which about 2·99 inches are received during the winter months.

The Institute was originally founded in 1905 at Pusa in Bihar. After the great earthquake of Bihar in 1934, it was transferred in 1936 to its present site in New Delhi. Administratively controlled by the Ministry of Food and Agriculture of the Government of India, the Institute, which has in recent years expanded considerably its facilities of experimental fields, buildings, scientific equipment and expert staff, is recognised as the premier institution of the country and constitutes one of the most important sources of expert technical knowledge, advice and instruction, both post-graduate and under-graduate, in agriculture and its cognate branches.

The Institute has inherited a great tradition of agricultural research going back to the work of Leather in agricultural chemistry, of Butler on fungi and fungal diseases of plants, of Maxwell-Lefroy and Fletcher in the cataloguing and combating of insect pests, and of the Howards in breeding new strains of crop plants, including the early "Pusa" wheats. Following upon such a lofty tradition came the successful work of Venkataraman at the Sugarcane Breeding Substation, Coimbatore (South India), which until recently formed a part of this Institute ; this work resulted in the production of the famous "Co. varieties " of sugarcane which have been largely instrumental in revolutionising the sugar industry in this country. The most notable recent achievement of the Institute has been the evolution, through planned breeding work, of a number of improved varieties of wheat, which are gaining popularity on account of their superior yielding ability and their capacity to resist the rust and the smut diseases which so commonly ravage the wheat crop in India.

The Institute's central library, housing over 150,000 books and annually receiving over 1,000 scientific journals and periodicals, is considered to be the biggest agricultural library in India.

The work of the Institute is carried out under its six Divisions : Agronomy, Botany, Entomology, Mycology and Plant Pathology, Soil Science and Agricultural Chemistry, and Agricultural Engineering. A seventh Division, Division of Horticulture, has been established very recently. The Units of Agricultural Economics and Agricultural Statistics, attached to the Division of Agronomy, are being developed into full-fledged sections in that Division. The Institute has substations located at Pusa (Bihar), Karnal, Simla, Indore, Wellington, Poona, Kalimpong, Bhowali and Katrain (Kulu Valley).

Besides the large number of research projects, fundamental as well as applied in nature, which are in progress in its seven Divisions, the Institute operates several research schemes financed by the Indian Council of Agricultural Research, the Indian Central Oilseeds Committee, and the Indian Central Sugarcane Committee.

In the field of post-graduate training in agriculture and the related sciences, the Institute offers facilities which are easily the best of their kind in the country today and which attract candidates from all over India and from some of the other Asian countries also.

DIVISION OF AGRONOMY

Agronomy is the art and science of husbandry of crops and livestock. It concerns itself with the scientific and technical aspects of soil management and crop production and aims at obtaining maximum production at the minimum possible cost.

Farm area. The farm area attached to the Division consists of 350 acres of irrigated and 115 acres of rainfed land, the latter area being developed for investigations on dry farming and soil conservation. The farm area under the Agricultural Research Station, Karnal, covers 180 acres. The area at the main Division at Delhi, as well as at the substation at Karnal, is mainly devoted to agronomic experimental work, as also for the large-scale production of pure seed stocks of improved varieties of crop plants, e.g. wheat, barley, oats, rice and linseed, evolved at the Institute.

Set-up of the Division. The work of the Division is divided into the following five sections: (1) soil fertility building, (2) vegetables and commercial crops, (3) agronomical trials, (4) farm and dairy and (5) grassland management. Besides, the Division looks after the Intensive Cultivation Scheme in 19 Delhi villages and the production of pure seed stocks of improved varieties for distribution.

Important Achievements

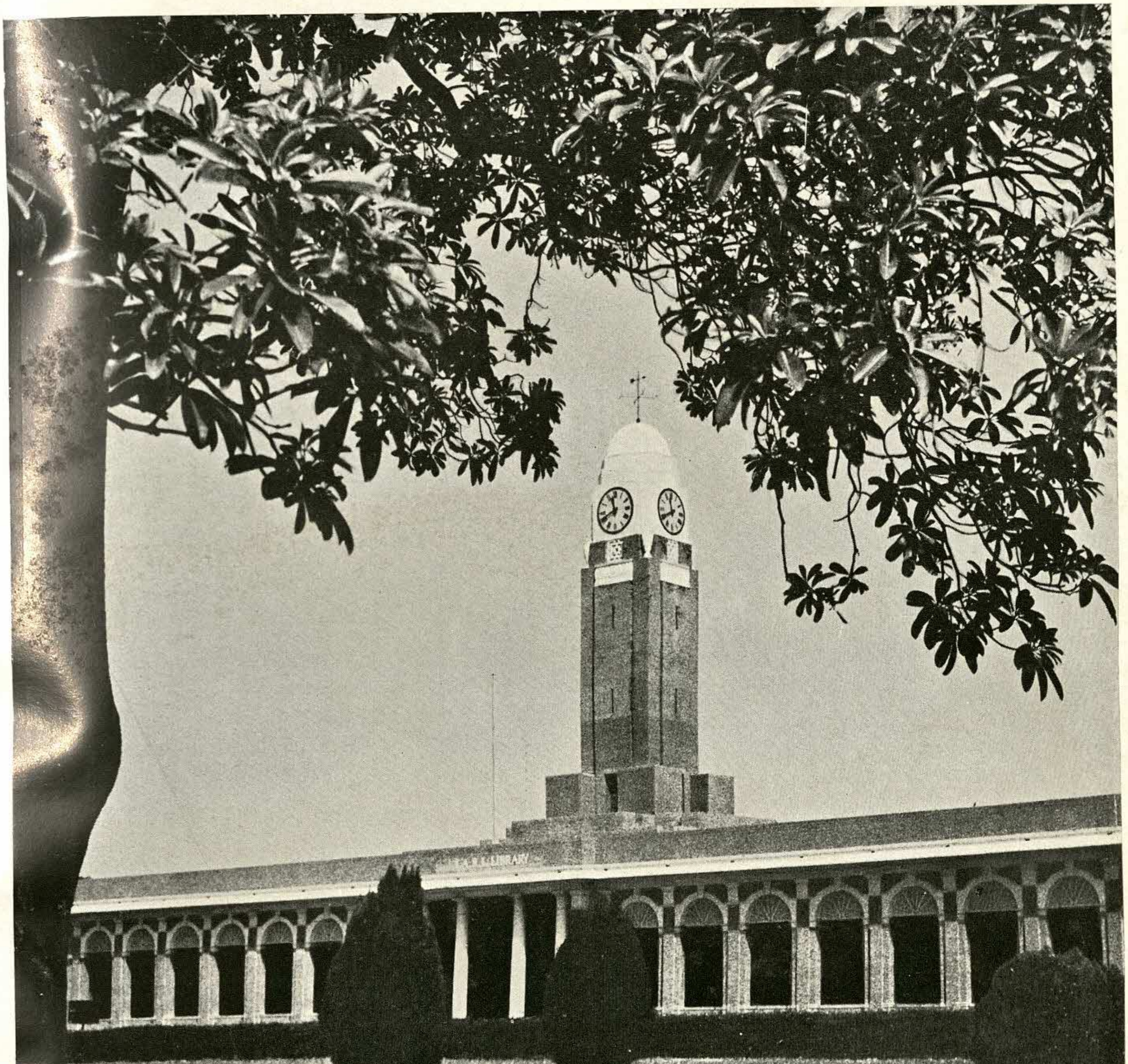
Soil management. Critical experiments conducted between 1940 and 1946 have brought out, in the case of soils of low phosphate status, the value of applying high doses of phosphate to the berseem crop in the building up of soil fertility. The application of phosphate to berseem, at 132 lb. of $P_2 O_5$ per acre, not only stepped up its mean fodder yield from 161 to 336 maunds per acre, but the following wheat crops, which were then not manured, gave increased grain yields to the extent of from 4.7 to 9.6 maunds per acre. This technique of building up soil fertility is being advantageously applied to other crops also, such as paddy. It was observed that fertilising berseem with 80 lb. $P_2 O_5$ per acre brought forth increased fodder yield of berseem and left from 40 to 60 lb. of extra nitrogen in the soil for the succeeding paddy crop.

Extensive investigations have been carried out to determine the levels of manuring of crops which, while being economical, would give the best possible crop yields. It was found that the application of more than 40 lb. of nitrogen per acre to wheat and paddy resulted, under pre-disposing conditions, in the lodging of these crops and that it was wasteful to apply more than 200 lb. of nitrogen per acre to a paddy nursery. The optimum manurial dose for sugarcane was 100 lb. of nitrogen applied over a basal dressing of 10 tons of farmyard manure per acre. Maize was found to respond best to 60 lb. and potato to 120 lb. of nitrogen per acre, and high yields of tobacco resulted from a dressing, after transplanting, with 80 lb. of nitrogen to the acre.

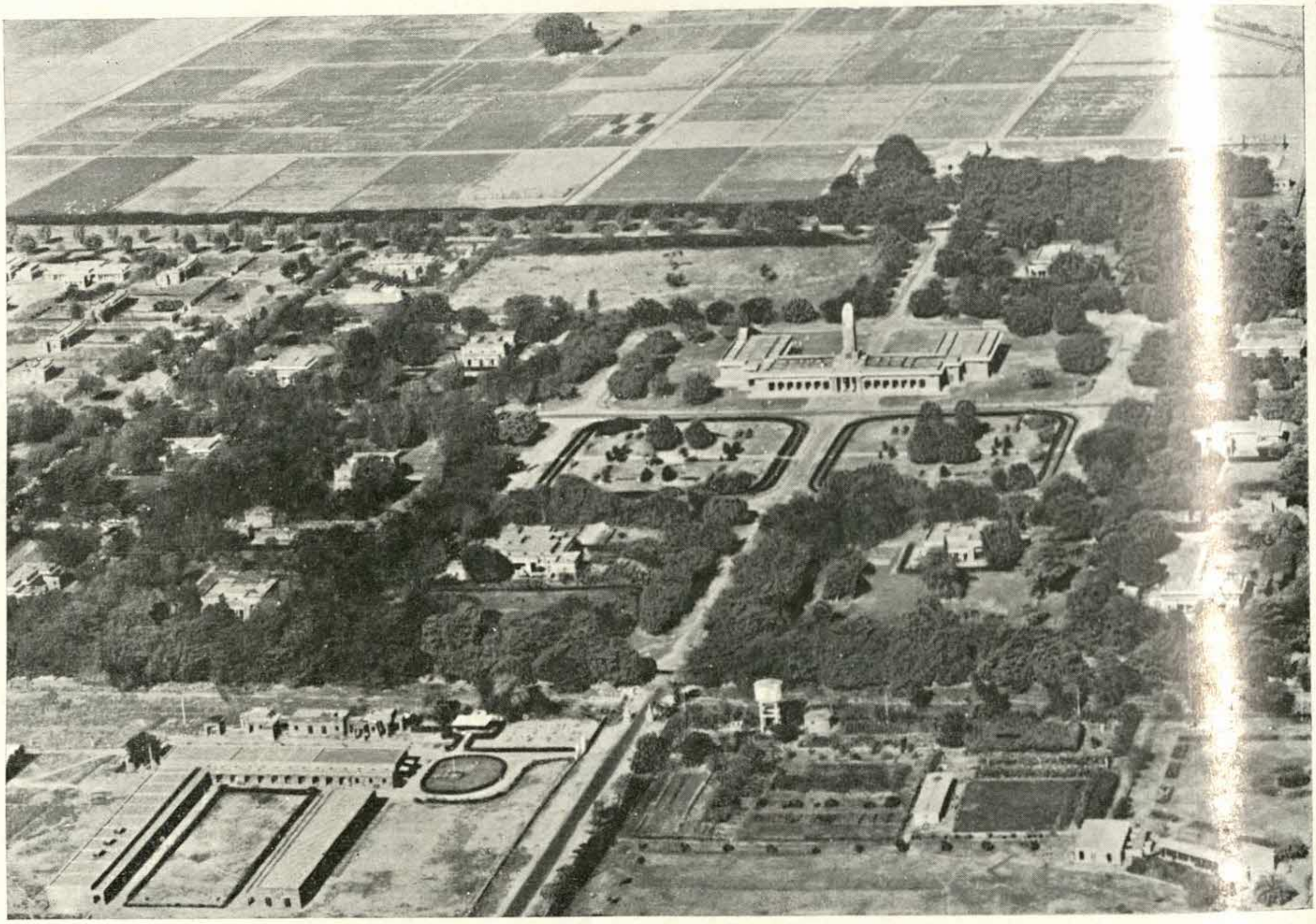
Experiments on soil cultivation conducted over seven years demonstrated that cultivation deeper than 10 inches does not give, in the alluvial Delhi soils, extra yields of sugarcane, wheat, maize or potato ; normally, therefore, shallow cultivation with the *desi* plough is quite adequate. About nine ploughings with the *desi* plough were found to be quite adequate for preparing a wheat field for sowing, more ploughings being unnecessary and wasteful. For *kharif* crops, six ploughings were about the best.

Crop husbandry. The Division, when it was at Pusa (Bihar), selected after conducting extensive

[PLATE VI



Library of the Indian Agricultural Research Institute

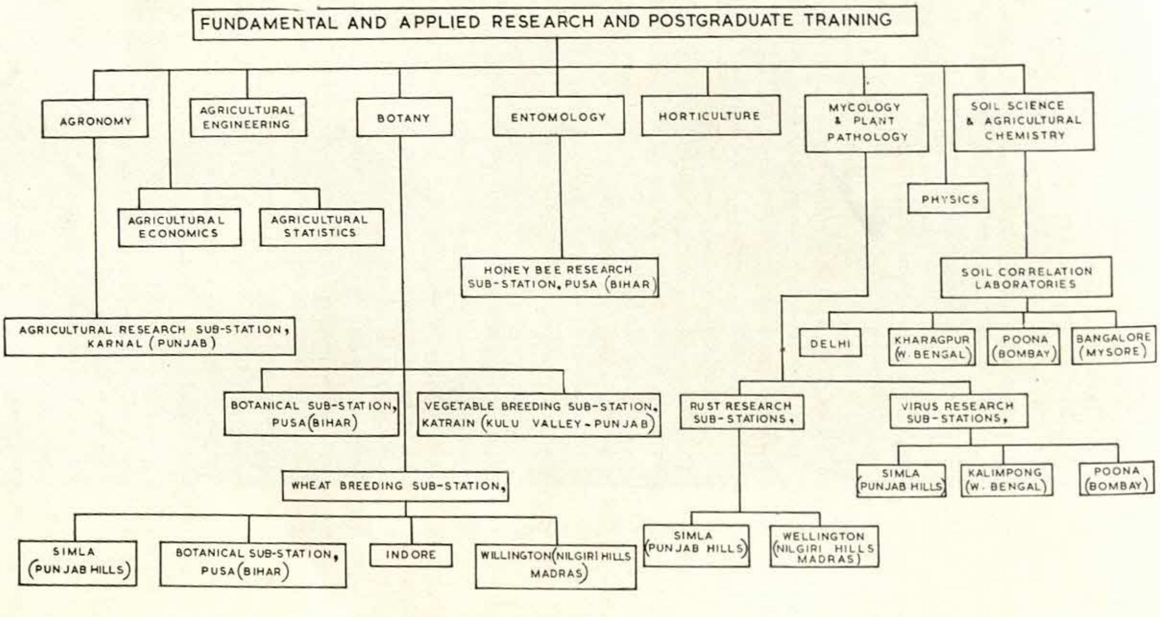


Aerial view of the Indian Agricultural Research Institute, New Delhi

INDIAN AGRICULTURAL RESEARCH INSTITUTE

New Delhi

Organisation chart


FUNDAMENTAL AND APPLIED RESEARCH AND POSTGRADUATE TRAINING
AGRONOMY
AGRICULTURAL ENGINEERING
BOTANY
ENTOMOLOGY
HORTICULTURE
MYCOLOGY & PLANT PATHOLOGY
SOIL SCIENCE & AGRICULTURAL CHEMISTRY
PHYSICS
AGRICULTURAL ECONOMICS
AGRICULTURAL STATISTICS
HONEY BEE RESEARCH SUB-STATION, PUSA (BIHAR)
SOIL CORRELATION LABORATORIES
AGRICULTURAL RESEARCH SUB-STATION, KARNAL (PUNJAB)
DELHI
KHARAGPUR (W. BENGAL)
POONA (BOMBAY)
BANGALORE (MYSORE)
BOTANICAL SUB-STATION, PUSA (BIHAR)
VEGETABLE BREEDING SUB-STATION, KATRAIN (KULU VALLEY - PUNJAB)
RUST RESEARCH SUB-STATIONS,
VIRUS RESEARCH SUB-STATIONS,
SIMLA (PUNJAB HILLS)
KALIMPONG (W. BENGAL)
POONA (BOMBAY)
WHEAT BREEDING SUB-STATION,
SIMLA (PUNJAB HILLS)
BOTANICAL SUB-STATION, PUSA (BIHAR)
INDORE
WILLINGTON (NILGIRI HILLS MADRAS)
SIMLA (PUNJAB HILLS)
WELLINGTON (NILGIRI HILLS MADRAS)

performance trials, the Coimbatore varieties, Co.210, Co.213, Co.214 and Co.313, of sugarcane. The release of these varieties in north Bihar and their subsequent spread in south Bihar, Uttar Pradesh and Bengal resulted in the complete replacement of the indigenous low-yielding canes with these superior varieties. This augmented sugarcane yield in the Gangetic plain by about 50 to 75 per cent and led to the firm establishment of the sugar industry in this tract.

This Division is credited with being the first to establish the superiority of berseem, a high-yielding nutritious fodder plant introduced from Egypt, over the other leguminous and non-leguminous fodders cultivated during *rabi* in northern India.

The permanent rotation-*cum*-manurial experiments, started by the Division at Pusa in 1908, have continued to be conducted there. These experiments have established, among other things, the beneficial effect of legumes in various crop rotations for maintaining high yields from cereal crops. Green manuring with sunn-hemp, which is dressed with phosphate, has proved to be very effective in keeping up soil fertility. Another series of rotation-*cum*-manurial experiments, run at Delhi for over ten years, confirmed these results. It has also been established that it is profitable to grow a crop of fodder cowpeas instead of keeping the land fallow ; this does not adversely affect the yield of the subsequent *rabi* crop of wheat.

A number of intensive-cropping experiments have shown that a small, six-acre holding, when fertilised with farmyard manure and phosphate, can produce sufficient quantities of cereals, cash crops, pulses, milk and fodder and feeds to maintain a family of five persons at a moderate standard of living, and would also enable the family to keep the necessary bullocks and milch stock.

Cattle breeding and management. The Sahiwal herd of milch cattle bred in this Division was founded in 1904, and is considered to be one of the best in the country and in the words of Professor Wright, a world authority on dairying, ' one of the best consistent-performing herds in the world.'

Systematic line breeding, together with scientific feeding and proper management, has resulted in the increased milk yield and in the high consistency of performance of the herd. Milking four times a day was introduced in 1932-33 and has since been continued. This practice has considerably raised the milking average of the two herds, without loss in vigour of the animals. Tamili, one of the best Sahiwal animals, gave a lactation yield of 13,004 lb. in 306 days ; in 8 lactations she yielded 80,528 lb. of milk. Breeding experiments undertaken to induce early maturity in the herd have enabled the cows to give one extra lactation and the bulls to start service earlier. The practice of premilking has prevented the incidence of mastitis and milk fever in the herd. To help up-grading the milch stock in the country, 640 pedigreed Sahiwal and 274 pedigreed Tharparkar bulls were sold through the years to several State Departments of Agriculture and to private individuals.

Grassland improvement. A good collection of indigenous and exotic grasses and legumes, comprising 2729 items belonging to 101 species of grasses and 65 species of legumes, has been built up. Eight among the species of grasses and five legumes have been found to be high yielding and particularly useful. The Rhodes grass (*Chloris gayana*) has been well established under irrigation, the blue panic (*Panicum antidotale*) under semi-arid conditions and the *anjan* grass (*Cenchrus ciliaris*) under arid conditions. Particularly interesting is the legume (*Dolichos lablab*) which is a nutritious fodder legume easy to harvest because of its ' carpet-forming ' habit. The hubam clover (*Melilotus alba*) has wide possibilities of cultivation in India. The kudzu vine is now increasingly in demand owing to its immense potentialities for natural grazing and control of soil erosion ; a kudzu variety from Assam remains green during the winter months at Delhi.

Schedules have been worked out for the regulated sowings of proper combinations of grasses and legumes which would ensure an adequate and continuous supply of fodder throughout the year, including the scarcity months of November-December and May-June.

Investigations in progress

Some of the important lines of investigation in progress include the following :

Soil management

(*i*) Permanent manurial-*cum*-rotational experiments at the Botanical Substation, Pusa (Bihar) and at the main Division at Delhi, designed for the study of crop rotation and fertilisation practices in relation to the building up of soil fertility, have been undertaken.

(*ii*) The Division is co-operating in an all-India scheme, sponsored by the Indo-American Technical Co-operation Mission as part of the National Five-Year Plan, for testing the relative responses of paddy, wheat and *jowar* to different types of nitrogenous and phosphatic fertilizers.

(*iii*) The investigations on the phosphate manuring of berseem have been extended to include other leguminous crops to test their ability to build up soil fertility. Studies on the effect of placement of phosphate and of the interaction between levels of nitrogen and levels of irrigation are under way on a number of crops.

(*iv*) Experiments have been initiated on weed control in crop fields by the use of chemical weedicides.

Crops husbandary

(*i*) Long term crop rotation experiments have been planned to study, among other things, the comparative merits of short and long term rotations, the economics of inclusion in them of certain cash crops like potato, cotton and sugarcane, as also of some fodder crops, and the problem of maintenance of soil fertility. The experiments were started in 1949-50 and will continue for a period of about 15 years.

(*ii*) The experiments on intensive cultivation in six-acre holdings are in the second cycle and are in operation both at the main Division and at the Karnal Substation.

(*iii*) Investigations are in progress on mixed cropping with cereals (wheat in *rabi* and *jowar* in *kharif*) and different pulse crops ; the object is to work out the optimum seed rates for the mixture and the associated and residual effects of legumes on the crop.

(*iv*) Large-scale performance trials have been undertaken with the new improved crop varieties, such as those of rust-resistant wheat and linseed, hybrid maize, sugarcane, wilt-resistant pigeon pea, pungent and non-pungent chillies, *jowar*, *bajra* and certain oilseeds.

Cattle Breeding and Management

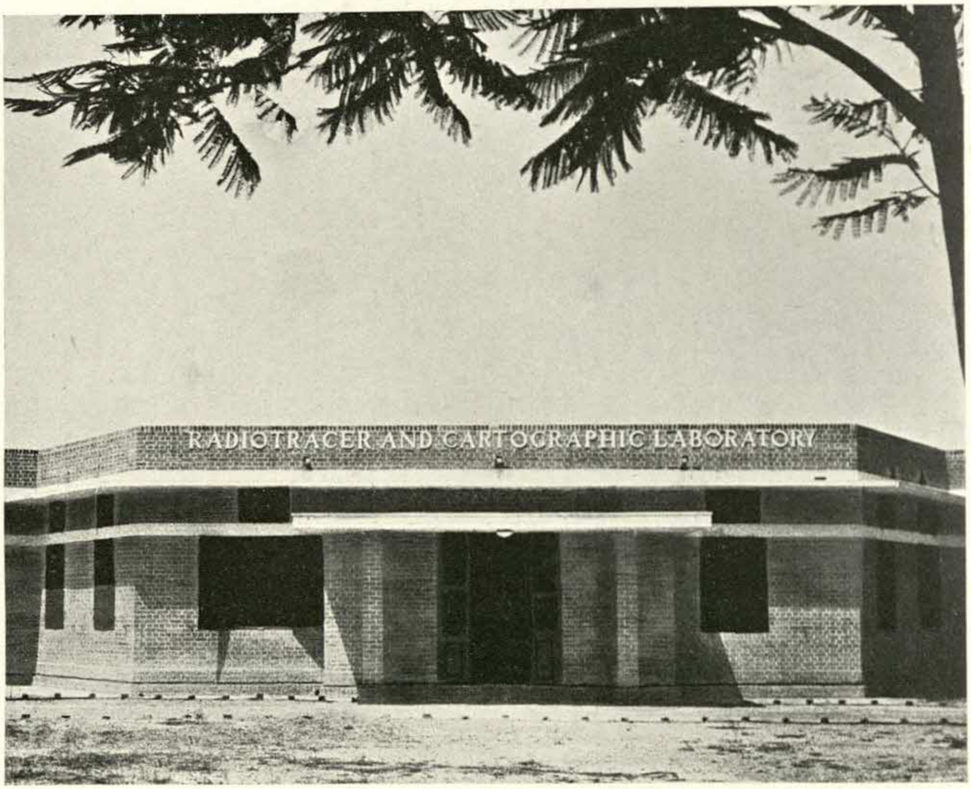
Line breeding work is being continued in the nucleus Sahiwal herd, the object being to step up the milk yield potential to 2½ gallons a day. Work is also under way on the induction of early maturity in the herd and on pre-milking and reduction in the dry period of cows.

Grassland Improvement

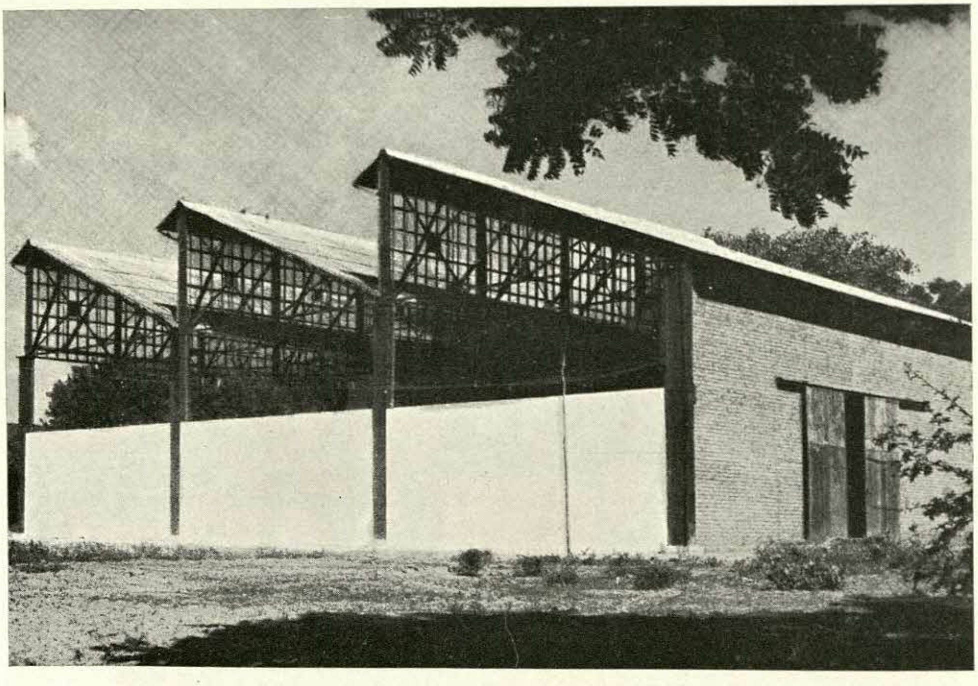
(*i*) Co-operative trials, with the different States in India, of selected grasses and legumes are being conducted. A scheme financed by the Indian Council of Agricultural Research

Botany Division, Indian Agricultural Research Institute

Division of Mycology and Plant Pathology, Indian Agricultural Research Institute



The Radiotracer and Cartographic Laboratory, Indian Agricultural Research Institute



Workshop of the Division of Agricultural Engineering, Indian Agricultural Research Institute

is in operation for work on collection and study of indigenous and exotic grasses and legumes.

(*ii*) Ley-farming experiments, aiming at working out methods of production of maximum fodder while building up soil fertility, have been undertaken. The work on pasture management for obtaining a regulated fodder supply throughout the year is being continued.

DIVISION OF BOTANY

Increasing the yield per acre of various crops, more especially the food crops, by replacing the existing local types with superior strains has been the main objective of the work of this Division. Long-term and basic problems of plant breeding and the cognate sciences, suitable for a Central Institute, are selected. Attention is also devoted to the development of new breeding techniques.

Laboratory and equipment

This Division has laboratories well equipped for research and post-graduate teaching in several branches of agricultural botany, viz. genetics and plant breeding, cytology, crop physiology, systematic and economic botany. An experimental area of 50 acres is attached to the Division.

For the study of plant materials under varying conditions of soil and climate, there is a permanent substation at Pusa (Bihar). There are five other substations, under the Co-ordinated Wheat-Rust Control Scheme, located at Simla, Pusa (Bihar), Bhowali (U.P.), Indore and Wellington (S. India). At Katrain (Kulu Valley) is located a substation for vegetable breeding.

Set-up of the Division

The Division comprises the following Sections:

(1) Genetics and plant breeding, (2) Cytology and cytogenetics, (3) Crop physiology,
(4) Plant introduction, economic botany and systematic botany.

The objective of the Section of Plant Breeding and Genetics is the evolution of superior varieties by selection in natural populations and in progenies obtained from planned hybridisation between varieties of crop plants, and sometimes also between crop plants and their wild relatives and allied species and genera. A high out-turn and good quality of the produce are undoubtedly major considerations, but in each crop there are specific objectives for which breeding programmes have to be suitably orientated.

The letters, 'N.P.', standing for 'New Pusa', are prefixed to the numbers of the improved strains of crops bred at this Institute, e.g. the new wheat varieties, N.P. 710, N.P. 718, etc.

Important achievements

As a result of the work carried out during the earlier years at Pusa (Bihar), and later at New Delhi, improved strains were produced in many crops, such as wheat, paddy, barley, oats, linseed, safflower, *Sesamum*, *Hibiscus*, tobacco, chilli, gram, pigeon pea, green gram, black gram, peas and lentils.

Pusa wheats. The famous Pusa wheats were a notable achievement. Many of the Pusa wheats compared very well with the best-quality North American spring wheats. N.P. 4 won several prizes for grain quality in exhibitions held abroad. Wheat varieties like N.P. 4, N.P. 12, N.P. 52 and N.P. 165 soon occupied a considerable area, at one time estimated to run into several million acres. Some of these varieties are still popular.

New wheats for old. A notable achievement of the last few years has been the evolution of a new series of improved wheats—the '700-series', several of which have given outstanding performances in trials conducted at many centres in India. Their special characters include adaptability to certain regions, high yield, good grain quality, tolerance of the rusts and resistance to loose smut. N.P. 710 was found to be the most widely adapted among them and has given very promising results especially in Uttar Pradesh where the Department of Agriculture recently decided to replace Punjab C. 591, its standard variety for western Uttar Pradesh, with N.P. 719. The Uttar Pradesh Government have also recommended N.P. 720 and N.P. 775 for cultivation in certain areas in that State. N.P. 770 has done exceedingly well in the hills of northern India, and in Himachal Pradesh; it is being multiplied on a large-scale for distribution to growers. In Delhi, N.P. 718 has found favour with farmers; it is in great demand here and also in parts of Rajasthan. The strain N.P. 809, recently released for hill areas from the Simla Substation of this Institute, is the first wheat to be evolved resistant to all the three rusts.

Rust-resistant linseed and wilt-resistant pigeon peas. The older Pusa linseeds were high yielding and had high oil content but were susceptible to linseed rust. In fact all the indigenous linseeds were found to be susceptible to rust. By crossing them with resistant exotic varieties, a number of superior rust-immune strains were evolved. Trials of the newly evolved rust-resistant strains of linseed at several centres in India, indicated the superiority of many strains, such as N.P. (R.R.) 5, 9, 37, 38, 40, 45, 204, 262 and 267, (R.R. standing for rust resistant). A number of wilt-resistant, agronomically superior strains of pigeon pea have also been bred.

High yielding potatoes. This crop had received but scant attention in India during the early years. In 1935, the Potato Breeding Substation of the Institute was established at Simla with financial assistance from the I.C.A.R. An extensive collection of the Indian potato varieties was built up, analysed and described. Simultaneously, large collections of exotic varieties, as also of related wild species from South and Central America, were built up and studied; many of them were of immense breeding value. A large number of crosses were made between the Indian and foreign potato varieties, and several promising hybrids were obtained. Experiments conducted during the past decade established the superiority of a number of these potato hybrids. Thus, Hybrids Nos. 45, 208, 209 and 610 were among those that proved outstanding in the plains of the Punjab, Uttar Pradesh and Bihar. In the hills, Hybrid Nos. 9 and 12 reached the multiplication stage in Uttar Pradesh and Nos. 5 and 9 in West Bengal. In 1949, the work on potatoes was transferred to the newly established Central Potato Research Institute.

Tobacco improvement. Co-ordinated researches at Delhi, Pusa, and at the Tobacco Research Substation, Guntur, yielded much useful information on the influence of varieties and manurial treatments on the yield and quality of tobacco. Experiments on flue-curing carried out at the Old Pusa paved the way for the starting of the cigarette tobacco industry in India. A notable result was the selection at Guntur of 'Amarelo 5', a new type of cigarette tobacco, superior in curing properties and yield of top-grade leaf to the prevailing variety, Harrison's Special. A new type of chewing tobacco, N.P. 70, was released for distribution. The substation at Guntur was later transferred to the Indian Central Tobacco Committee.

A number of new, high-yielding types of hookah-tobacco (*Nicotiana rustica*), with high nicotine content, have been recently evolved at Delhi. Some of them, such as Selections 19 and 20 (now designated as N.P. 219 and N.P. 220), have found favour with growers around Delhi.

Utilisation of hybrid vigour. The economic possibilities of the utilisation of hybrid vigour were examined in crops like maize, tobacco, chillies, brinjal and bitter-gourd. In the case of maize, a number of foreign hybrids were tested at about 20 centres in India. Some of them, like N.C. 27, Dixie 11, Dixie 22, U.S. 13 and Texas 26, have done very well at many centres. A brinjal hybrid, named Pusa Purple, gave higher fruit yield than the parents and other commercial varieties. Seeds of this hybrid have been supplied to interested growers.

Utilisation of wild relatives of crop plants. Wild species and genera related to crop plants often possess valuable properties, like hardiness and resistance to drought, diseases and pests; they, therefore, constitute valuable material for plant breeding. By crossing cultivated tomato (*Lycopersicon esculentum*) with the wild South American species (*L. pimpinelifolium*), a number of hybrid varieties have been produced; Hybrid 6, now called Pusa Red Plum, is rich in sugar and vitamin C contents and is suitable for eating uncooked and also for the production of juice. In *til*, i.e. cultivated sesame (*Sesamum orientale*), promising lines have been evolved by crossing it with a wild species (*Seasamum prostratum*) which is resistant to the greenflower or phyllody disease.

Plant introduction. Over 1200 items of both indigenous and exotic plants have so far been collected by the Plant Introduction Section. Some of the imported varieties, when tried at several centres in India, appeared to be worthy of direct economic exploitation. The Australian wheat variety, Ridley, has been doing well in several areas in the hills of northern India. The Chinese sweet potato variety, F.A. 17 now named "Pusa Sufaid", has given outstanding results. An American variety of tomato, Sioux, has been found to be a promising variety, being early ripening and high yielding. The 'Philippines Early' now named 'Pusa Barsati' vegetable cowpea flowers in 35 days from germination when grown as a monsoon crop. Three American varieties of garden pea, viz. Early Badger (early), Delwiche Commando and Bonnewille (midseason), have been found to be superior to the varieties at present in cultivation. Seeds and planting material of these promising varieties, including a number of improved vegetable varieties, have been distributed in recent years to growers in several States.

The use of cytogenetical technique. An interesting piece of work done in this Division some time ago was the experimental demonstration that cultivated *rai* (*Brassica juncea*, 2*n*—36) arose in nature through crossing between a *toria*-like parent (*B. campestris* var. *toria*, 2*n*—20) and *Banarsi rai* (*B. nigra*, 2*n*—16) followed by doubling of the chromosome number in the first generation hybrid. Such instances illustrate how new and useful species can be created from old ones. Another example of the use of cytogenetical technique in crop improvement is that of polyploidy. Polyploids of a number of crops hve been obtained through colchicine treatment and studied at New Delhi; those of the oil-bearing Indian rape, *toria*, and the fodder crop berseem, appear to be economically promising.

Investigations in progress

Some of the more important investigations in progress at present are mentioned below:

(i) *Breeding wheats for resistance to rust.* Considering the complexity of the rust problem and the diversity of climatic and soil conditions in the various wheat-growing regions in India, work on rusts has recently been intensified and integrated under the Co-ordinated Wheat Rust Control Scheme, and research substations have been established at six places, viz. Delhi, Simla, Pusa, Indore, Wellington and recently at Bhowali (Uttar Pradesh) to breed rust-resistant varieties suitable for the respective regions. Breeding for resistance to the smut and bunt diseases, as also for superior milling, baking and *chapati*-making qualities is also in progress. A milling and baking laboratory, equipped on modern lines, is being fitted up in this Division with the co-operation of the Indo-American Technical Co-operation Mission.

(ii) *Hybrid maize.* Work is in progress on the testing of inbred lines produced from the Indian and foreign material. Researches are also under way on certain fundamental aspects chiefly concerned with the improvement of the methods of hybrid seed production. Under an I.C.A.R. scheme, work on hybrid maize has recently been considerably expanded on a regional basis and the Institute has been entrusted with its execution in a well-co-ordinated manner in co-operation with the Rockefeller Foundation.

(iii) *Crop improvement through colchicine-induced polyploidy.* The polyploidy breeding technique, involving the induction and study of auto- and allo-polyploids is being employed in breeding work on *toria*, berseem, linseed, wheat, cotton, *bhindi* and some other crops.

(iv) *Induction of mutations.* Mutagenic agencies, such as X-rays, ultra-violet rays, neutrons and radio-active isotopes, are being used for the induction of useful mutations in several crops including wheat, cotton and linseed.

(v) *Plant physiology.* Interesting work is in progress, mainly in the wheat crop, on resistance to drought and lodging, on the physiological analysis of yield in wheat, on the theoretical and practical aspects of the role of hormones on crop growth and development, and on the role of micro-nutrient elements in relation to certain diseases of citrus.

(vi) *Plant introduction.* The nucleus plant introduction unit established in 1946 has now emerged as the full-fledged Plant Introduction and Exploration Organisation on a permanent all-India basis. A number of substations are being set up under this Organisation.

New activities

An horticultural section has recently been set up in this Division for research on fruits and fruit trees and it is now being organised into a separate Division of Horticulture under the Institute. A unit has been established for work on the artificial culture of young embryos. Also, a strong, well-equipped unit has recently been organised for mutation research with the object of subjecting a number of the major crop plants to agencies like X-rays, ultra-violet rays, neutrons and radio-active isotopes for obtaining agriculturally-useful mutations. For this purpose, steps are being taken to set up a field where radio-active Cobalt, Co. 60, will be installed.

DIVISION OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY

The principal objective of this Division is to study the soils of India in relation to their crop producing capacity and to carry out investigations on soil conditions and manurial practices which would help in increasing the yield and quality of agricultural produce obtained from the land. For this purpose, systematic work is being carried out on soil survey, preparation of soil maps, study of the physical, chemical and micro-biological properties of soils and of the other soil conditions necessary for obtaining a high crop yield. Studies are also conducted on new types of fertilizers and manures, on the relative merits of applying them in various combinations, as also on their effects on soil biology and plant nutrition, the object being to increase the crop producing power of Indian soils without impairing their inherent fertility. Special attention is also paid to problems such as those pertaining to the fertility status of soils, and the conditions under which legume crops would fix the maximum amount of atmospheric nitrogen. Other investigations in progress relate to the control of adverse soil factors, such as erosion, salinity, alkalinity and acidity, as also to the analysis of irrigation waters, preparation of new insecticides, fungicides and synergists from indigenous resources and the study of meteorological factors influencing crop yield.

Laboratories and equipment

The laboratories of this Division are well-equipped with modern instruments, including those required for micro-biological, electro-chemical and spectro-chemical studies, and are used in carrying out investigations on the various aspects of soil science and agricultural chemistry.

Set-up of the Division

The activities of the Division are carried out under the following five sections: (1) Agricultural Chemistry (including soil fertility and soil micro-biology), (2) Soil Survey and Soil Physics, (3) Physical Chemistry, (4) Plant Chemistry (including organic chemistry and bio-chemistry), and (5) Physics.

Important achievements

The following is a brief account of some of the important items of work in the Division in comparatively recent years.

A soil map of India, prepared in this Division, was published in 1943. The revised map was printed in 1954. It shows the distribution of the major soil groups in India and their relation to geographical factors, such as, the parent rocks, and climatic factors, including the mean precipitation, mean temperature and moisture deficit. The map serves as a useful basis for the classification of Indian soils and for work relating to the planning of proper land use.

India possesses several million tons of phosphatic rocks at Singhbhum (Bihar) and Tiruchirapalli (Madras), but the phosphate is present in an insoluble form and hence unavailable to plants. Methods have been worked out in the Division for rendering the phosphate soluble by the biological method of composting or fermenting the phosphate rock, in powdered form, with sulphur or with cattle-shed refuse. The composted rock phosphate has another advantage which is as follows: when superphosphate is applied to soils for increasing crop production, there is a tendency for the soils, especially the acid soils, e.g. the red soils or laterites which are rich in active iron or alumina, to revert or to fix it in an insoluble form. It has been demonstrated that such reversion of phosphate in the soil can be appreciably minimised by applying composted phosphate to it ; such application gives higher crop returns than does the straight application of phosphate to the land.

Work done in this Division has led to the isolation and culturing of active strains of bacteria specific for particular legume crops, e.g. berseem, sunn-hemp, *dhaincha* and peas. It has been found that inoculation of the seed with the specific bacterial culture considerably increases the growth of the legume crop and thereby much more of atmospheric nitrogen is fixed in the soil than would be done by the legume crop without the added bacterial culture. Cultures of specific legume bacteria are in great demand from farmers and their supplies are regularly mailed to indentors.

A cheap and efficient method has been worked out in the Division by which combustible gas, which can be used as household fuel, is obtained from dung and other organic wastes ; the spent residue serves as good-quality manure.

As a result of work carried out in the direction of better utilisation of agricultural by-products, methods have been worked out and standardised for the preparation of butanol and acetone from molasses and of pure starch from mango-seed kernels.

Investigations in progress

The manurial value of some new alternative sources of nitrogen and phosphatic fertilizers, e.g. ammonium chloride, urea, ammonium sulphate nitrate, dicalcium phosphate, Singhbhum and Trichy phosphates and processed bonemeal, is being examined in laboratory and field tests. Methods of efficient utilisation of superphosphate and rock phosphate by composting and through leguminous rotations are under study. The work of studying, and demonstrating to farmers in the country, the value of fertilizers, both old (e.g., ammonium sulphate, superphosphate, etc.) and new, is being done on an all-India basis. The chemical composition and nutritive value of Indian wheats grown under different soil and climatic conditions are also under study.

In the field of physics, work is in progress on the comparative analyses of micro-nutrients by spectrographic, colorimetric and chemical methods and on the spectrographic estimation of alkali and alkaline earth metals in soils. The effects of micro-and macro-climates on the growth and yield of wheat are also under investigation.

New activities

Mention has already been made of the co-operative activities on fertilizer use carried out in the country in co-operation with the Indo-American Technical Co-operation Mission. A radio-tracer laboratory has been established for conducting work on the determination of the availability of phosphorus in soils by means of radio-tracer techniques.

A cartographic section has been developed. Maps prepared in this section by the use of the latest techniques would be of great use to agricultural workers in the country.

Under a co-ordinated all-India scheme, a soil testing laboratory, equipped on the most modern lines, is being set up.

DIVISION OF ENTOMOLOGY

The activities of the Division of Entomology are directed towards devising cheap and efficient measures for controlling the insect pests of crop plants.

To achieve this objective it is necessary to correctly identify the insects concerned, and to gather an intimate knowledge regarding their habits and life histories with a view to discovering the most vulnerable stages in their life-cycles during which suitable control measures could be effectively taken. Towards this end it is also necessary to study the geographical and seasonal distribution of these insect pests both in space and time and also to have knowledge of their natural enemies, parasites and predators. Investigations are also undertaken on the ecology of insects which would throw light on the origin and causes of insect outbreaks, and on the toxicology of insects for formulating methods of controlling these pests effectively by using a variety of insecticides, fumigants and ' inert ' dusts.

Laboratories and equipment

The laboratories of the Division are well equipped for research in pure and applied entomology and consist of the main building, a parasite laboratory and a fumigatorium.

Set-up of the Division

The work of the Division is carried out in three Sections, viz. (1) Systematic Entomology, (2) Parasitology, and (3) Insect Ecology and Toxicology.

During the last 42 years, a large and valuable collection of named Indian insects, belonging to about 15,000 species, has been built up by survey and collection of insects from all over India, and by mutual exchange wih different States in India and with many neighbouring countries and Europe. This collection, known as the National Pusa Insect Collection, is one of the best of its kind in the East and constitutes a valuable asset in research work on systematic entomology.

The Parasite Laboratory is fairly well equipped for carrying out research work both in the fundamental as well as applied aspects of insect parasitism.

The basis of all pest control measures is a study of the biology and ecology of the insect pest. Studies on the forecasting of insect outbreaks and their effective control inevitably go together. Therefore a well-organised sub-section for ecological research of insect pests has been developed. In 1948 a sub-section for toxicological researches was also organised.

Important achievements

When the Entomology Division commenced work in 1905, the insect fauna of the Indian region and its bionomics were almost unknown subjects. Maxwell Lefroy, who was the first Imperial Entomologist, made full use of the opportunities in this unexplored field, and in 1906 he published an excellent manual entitled *Indian Insect Pests,* which was followed in 1909 by the publication of the monumental work, *Indian Insect Life.* In subsequent years, considerable detailed work was done on the bionomics and life-histories of several insect pests of economic importance.

Special attention has been paid to *Ichneumon* flies which belong to a family of great economic importance in the biological control of insect pests. One of the practical achievements of the Division has been the demonstration of the application of the method of biological control, under Indian conditions, of the sugarcane stem borer, *Argyria sticticraspis,* and the root borer, *Emmalocera depressella,* by large-scale releases of their natural egg parasite, *Trichogramma evanescens minutum.* It has been found by field experiments carried out for a number of years that when the outbreak of the sugarcane borer is severe, the parasite (*Trichogramma*) is effective in reducing the pest population. *Trichogramma* parasites are being produced by the million for this purpose. The cost of treating one acre of sugarcane is very low. Attempts are also being made to combine the use of *Stenobracon deesae,* the larval parasite of the sugarcane top-stem and root-borer, with the egg parasite, *Trichogramma.* The larval parasite, *Stenobracon,* is being produced in large numbers on the laboratory host, *Corcyra,* and its natural host, *Chilo zonellus.*

Investigations have also been actively carried out on the biological control of the potato tuber moth, *Gnorimoschema operculella,* by an exotic larval parasite, *Bracon gelechiae,* imported from Canada.

A survey of the beneficial parasites and predators of the San Jose scale, *Quadraspidiotus pernicusos,* a destructive pest of apple, plum and pear, was made in the Kashmir valley in the summer of 1951. Five genera and species of chalcid parasites, hitherto unrecorded on the San Jose scale anywhere in the world, were recorded for the first time. In addition to this, one species new to science was also recorded. Two Coccinellid predators on San Jose scale were recorded for the first time. The results obtained in this survey, covering the whole of the Kashmir valley, are of significance in the biological control of this pest.

Researches aiming at obtaining a thorough knowledge of the ecological armature of the important insect pests with the ultimate object of forecasting insect epidemics have been in progress. Special attention has been paid to the ecology of one of our major insect pests, the cotton bollworm. A method of sampling insect populations (cotton bollworm and some others) for computing the degrees of pest incidence has been standardised. The relationship between the relative effect on insect development of the constant temperatures maintained in the laboratory and the fluctuating temperatures of the field has been clearly established for the first time. The dynamics of temperature effect on insect development has been rendered clearer. Based on the above studies, an instrument called the 'Biometer' has been devised for estimating the number of generations of insect pests under the temperature conditions prevailing in the field.

The work on a number of schemes, financed by the Indian Council of Agricultural Research, viz. (i) an all-India survey of pests and parasites of sugarcane, followed by biological control of sugarcane pests, (ii) leaf-curl diseases of tobacco, (iii) survey of *Icerya purchasi*, (iv) pests of stored *jowar*, (v) codling moth, (vi) population studies, and (vii) San Jose scale, have supplemented the activities of the main Division. In 1939, the Government of India took over, on a permanent basis, the scheme on the desert locust ; the scheme was being financed by the Indian Council of Agricultural Research since 1931. The Locust Warning Organisation came into being in 1939 for the co-ordination of locust control operations with States in India and with neighbouring countries, such as Iraq, Persia and Afghanistan. When the Plant Protection and Quarantine Directorate of the Government of India was established in 1946, the Locust Warning Organisation was transferred to that Directorate.

Other lines of research work in progress in the Division include that on the insect pests of stored grains and their control.

New activities

Amongst the new investigations which have been taken up recently, the study of the biology and control of white ants and the use of radio-active isotopes in entomological research may be specially mentioned.

DIVISION OF MYCOLOGY AND PLANT PATHOLOGY

The Division of Mycology and Plant Pathology conducts research on plant diseases caused by fungi, bacteria and viruses with a view to facilitate the evolving of suitable control measures. The Division also collaborates closely with the Division of Botany in evolving disease-resistant varieties of crops. The indentification of micro-organisms and study of their life history forms an essential part of the investigations.

Laboratory and equipment

The laboratory is well equipped for mycological and plant pathological research and has two acres of land attached to it for experimental work. A mycological herbarium and a collection of type cultures of fungi and bacteria are maintained in an under-ground room equipped with cool cabinets.

Set-up of the Division

The Division consists of three main sections : (i) Plant Pathology, (ii) Plant viruses, and (iii) Systematic mycology.

Important achievements

The foundation of systematic mycology in India was laid in this Institute by Dr. Edwin J. Butler who was the first Imperial Mycologist. A classical account of the genus *Pythium* was published and it was followed by the description of other fungi. This work appeared in five parts as *Fungi Indiae Orientalis* and largely became the basis for Butler and Bisby's excellent monograph, *Fungi of India*, which was published in 1931 and which is now being revised and brought up-to-date. Another monumental work, *Fungi and Diseases in Plants*, had been published by Butler earlier in 1918.

Among the other earlier investigations may be mentioned the studies on the 'bud rot' of palms and rot of coconuts and their remedial measures which led to the saving of these crops in the Godavari delta when, some years ago, they were threatened with total destruction.

In subsequent years, special attention was given to the study of the Indian smuts and rusts. Four new genera of rusts and a number of new species of rusts and smuts were described. Similar systematic studies were carried out in a number of widely different genera of fungi, collected from different parts of the country, and thereby valuable additions to our knowledge of the fungus flora of India was made.

Cereal rusts constitute a major problem of national importance in this country. A large number of varieties and hybrid derivatives of wheat, as also of barley, have been tested in this Division for their reaction to the rusts and smuts. Many of these have been found to possess a good measure of resistance to these diseases and have given promising agronomic performances in tests carried out by this Institute in collaboration with several State Dapartments of Agriculture in India. The wheat varieties N.P. 114, 120, 165, 710, 718, 737 and 770 were found to be resistant to loose smut. A new type of bunt, designated as Karnal bunt, was for the first time discovered by research workers in this Division ; this fungal disease has been shown to be air-borne and knowledge has been gathered regarding the factors influencing the germination of its spores. A bacterial disease of wheat, locally known as *tundu*, has been shown to be associated with ear-cockle of wheat caused by a nematode. Time of sowing and soil moisture have been found to be the two factors which appreciably affect the incidence of the disease ; since the causal bacterium and the nematode are carried through galls, both the diseases can be controlled by removing the galls by floatation of the seed in water.

High temperature has been shown to favour the development of *Fusarium* wilt of gram, and it has been demonstrated that the incidence of the disease can be appreciably reduced if sowings are delayed until the last week of October or early November. This Division collaborated with the Division of Botany in the work of evolution of improved varieties of linseed resistant to all the four races of linseed rust (caused by *Melampsora lini*) so far recorded in India.

Simple practical schedules for the protection of the sugarcane crop against the two most serious diseases, i.e. red rot and smut, have been evolved and recommended. The occurrence of considerable secondary infection, as also of new and more virulent strains of the red rot fungus, has been shown.

The Division has been one of the pioneer research centres on plant viruses in India. The different potato varieties grown in this country have been found to be attacked by common virus diseases like mosaic, leaf-roll and various types of necroses. The viruses associated with these and related diseases have been studied and identified. Virus-free nucleus stocks of two potato varieties, Darjeeling Red Round and Up-to-date, were produced as a first step in the work of potato seed certification on a countrywide basis. Three strains of the sugarcane mosaic virus, some strains of cucurbit viruses and some new virus diseases of tomato have been described.

The mycological herbarium, established in 1901 under the name *Herbarium Cryptogamae Indiae Orientalis*, is one of the well known herbaria and is perhaps a unique repository of specimens of fungi in the East. It now houses about 21,000 specimens representing 937 genera and 5,000 species. Also treasured in the herbarium are 7,732 specimens from twelve well-known *exsiccati* sets prepared by renowned mycologists like Sydow, Briosi, Cavara, Rabenhorst, Brenckle, Jenkins, Bartholomew, and Fischer. Recently, work on the preparation of *exsiccati* sets of Indian fungi has been started and the first set, comprising the Indian Uredinales, has already been issued.

The Indian Type Culture Collection of the Division is the largest single collection of micro-organisms in the country ; in this work the Division co-operates with the International Federation of Culture Collections. Since its inception in 1936, the collection has steadily grown and the total number of fungi (including yeasts) and bacteria at present stands at 950.

Research in progress

Physiologic race analyses of wheat and linseed rusts are made every year to determine the prevalence and geographic distribution of known races, as also for discovering new ones. The object of this work is to facilitate the task of the breeders in the production of resistant varieties. Two new races of black rust of wheat (race 122 and one reported from Simla) have been discovered and the occurrence of a mutation has been observed.

Investigations on the green-ear disease of *bajra* causing serious losses in certain States, have been taken up. Successful infection of *bajra* seedlings has been obtained with oospores at the time of sowing.

The perithecial stage of the red rot fungus has been successfully produced in culture and also observed under field conditions for the first time in the country. The studies on antibiotics under way include investigations on the effect of the active principle produced by *Bacillus subtilis* and other soil organisms on the growth of the pigeon-pea wilt organism as also certain other parasitic fungi. The work on the study of factors underlying specialisation of parasitism has indicated that the activity of certain less-specialised parasites is dependent on the production of adequate quantities of certain active enzymes. Tissue culture work and work with radio-active isotopes has also been recently started.

The work relating to the production of resistant varieties of sugarcane against red rot and smut and of wheat varieties resistant to loose smut and rust is in progress in collaboration with plant breeders.

The study of viruses causing malformation in mango, leaf curl in papaya and mosaic in cardamom is receiving particular attention. Fundamental studies in plant viruses, e.g. cross immunity tests and purification, are in progress. The virus-vector relationship of the viruses causing yellow-mosaic of pumpkin, little leaf of egg plant, mosaic of bottle gourd and yellow vein mosaic of lady's fingers is also being investigated.

DIVISION OF AGRICULTURAL ENGINEERING

The main functions of this Division are to study the indigenous implements of the country, which have been evolved as a result of farming experience of many centuries, with a view to modifying or redesigning them in the light of scientific advances to improve their efficiency, and to try out foreign improved implements, particularly those that are horse-drawn or bullock-drawn or worked by human labour, and to make necessary adaptations in them to suit the conditions obtaining in India. The Division is also concerned with the testing of water-lifts and pumps, field trials of tractors and power implements, and also carries out a considerable volume of advisory work.

Workshop

The workshop consists of the following main sections : Machine shop, Carpentry and wood working unit, Blacksmithy, Electrical and welding section, and the Fitting and repair shop. Models of improved implements and experimental machines are made and tried out in the laboratory. Facilities for testing agricultural tractors, water lifts and other implements are available.

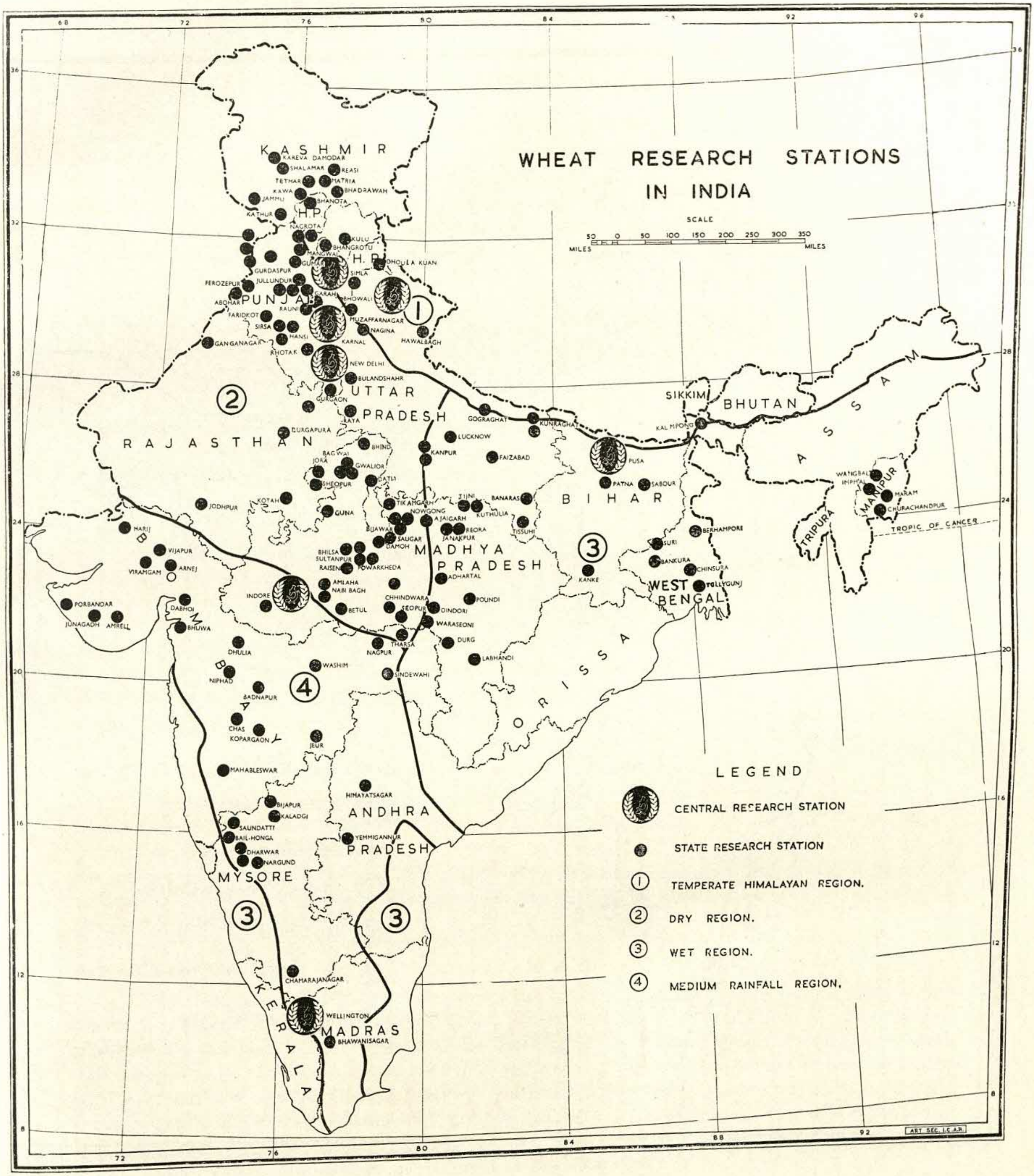
Set-up of the Division

The Division comprises four Sections with the following as their main activity :

(i) Testing of agricultural implements and machines including laboratory and field tests
(ii) Designing and fabrication of new implements and machines
(iii) Work relating to land development, land drainage and irrigation
(iv) Servicing and maintenance of experimental machinery and plants of the other Divisions of the Institute.

Important results

During the short period of its existence, the Division developed the following implements and machines :


WHEAT RESEARCH STATIONS IN INDIA
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STATE RESEARCH STATION
① TEMPERATE HIMALAYAN REGION.
② DRY REGION.
③ WET REGION.
④ MEDIUM RAINFALL REGION.
KASHMIR
KAREVA DAMODAR
SHALAMAR
REASI
TETHAR
MATRIA
KAWA
BHADRAWAH
JAMMU
BHANOTA
KATHUR
H.P.
NAGROTA
KULU
BHANGROTU
MANGWAL
GUMAN
SIMLA
DHOULA KUAN
GURDASPUR
FEROZEPUR
JULLUNDUR
GARAHI
ABOHAR
PUNJAB
RAUNI
BHOWALI
FARIDKOT
MUZAFFARNAGAR
SIRSA
NAGINA
HANSI
KARNAL
HAWALBAGH
GANGANAGAR
RHOTAK
NEW DELHI
BULANDSHAHR
GURGAON
UTTAR PRADESH
RAYA
GOGRAGHAT
KUNRAGHAT
SIKKIM
BHUTAN
KALIMPONG
ASSAM
DURGAPURA
LUCKNOW
RAJASTHAN
BHIND
KANPUR
FAIZABAD
PUSA
BAGWAI
JORA
GWALIOR
PATNA
SABOUR
SHEOPUR
DATIA
WANGBAL
IMPHAL
MANIPUR
MARAM
CHURACHANDPUR
KOTAH
JODHPUR
TIKAMGARH
JIJNI
BANARAS
BIHAR
GUNA
NOWGONG
AJAIGARH
KUTHULIA
TRIPURA
TROPIC OF CANCER
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BIJAWAR
SAUGAR
DAMOH
REORA
JANAKPUR
TISSUHI
BERHAMPORE
SURI
VIJAPUR
BHILSA
SULTANPUR
RAISEN
POWARKHEDA
MADHYA PRADESH
BANKURA
CHINSURA
ARNEJ
VIRAMGAM
BOMBAY
AMLAHA
NABI BAGH
ADHARTAL
KANKE
WEST BENGAL
TOLLYGUNJ
PORBANDAR
DABHOI
INDORE
CHHINDWARA
POUNDI
JUNAGADH
AMRELI
BHUWA
BETUL
SEOPUR
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WARASEONI
DHULIA
NAGPUR
THARSA
DURG
LABHANDI
WASHIM
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ORISSA
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BADNAPUR
CHAS
KOPARGAON
JEUR
MAHABLESWAR
HIMAYATSAGAR
BIJAPUR
KALADGI
ANDHRA PRADESH
SAUNDATTI
BAIL-HONGA
YEMMIGANNUR
DHARWAR
NARGUND
MYSORE
CHAMARAJANAGAR
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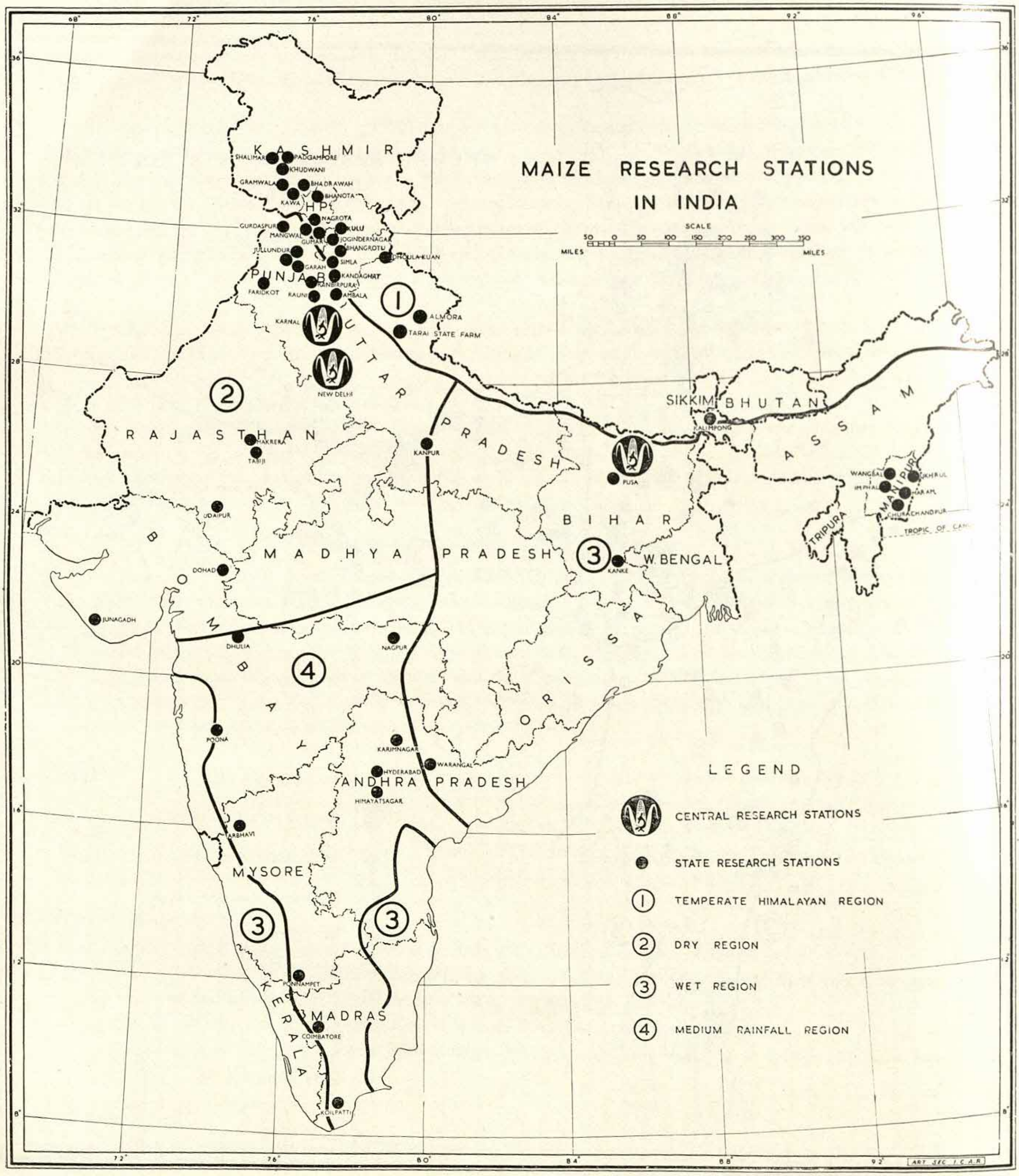
ART SEC. I.C.A.R.

PLATE XI]



MAIZE RESEARCH STATIONS IN INDIA

Jute seed-drill

Agronomic experiments carried out by the Indian Central Jute Committee have shown that yield of jute is increased when the crop is drilled in rows instead of being broadcast. It, therefore, appeared necessary to design a drill suitable for sowing jute seeds. At the request of the Indian Central Jute Committee, a four-row bullock-drawn seed-drill, which can sow one acre of land in an hour, was developed.

Rotary screen

Millions of tons of good compost manure is available in dumps on the outskirts of big cities and towns. But unwanted elements, such as bricks, stones, glass pieces and tin cans are usually found mixed with the material ; these have to be removed before the compost can be used for manurial purposes. A rotary hand-operated screen has been designed which sieves out the good manure.

Groundnut planter

A single-row, bullock-drawn machine, having automatic seeding arrangements, has been designed at the request of the Indian Central Oilseeds Committee for sowing groundnut. With slight modifications it can be used for sowing peas, beans and maize.

Investigations in progress

The most important among the investigations in progress in this Division are listed below :

(i) Investigations into the possibility of adapting certain Japanese agricultural implements and machines in India

(ii) Investigations on the introduction and development of better types of hand tools for harvesting crops

(iii) Improvement of the hand-operated cotton gin.

SUBSTATIONS

The Institute has a number of substations located at Karnal, Pusa (Bihar), Sila, Indore, Welington, Bhowali, Poona, Kalimpong (West Bengal), and Katrain (Kulu Valley).

Agricultural Research Substation, Karnal

The substation is primarily devoted to large-scale agronomic experiments, the crops grown include rice, wheat, maize, *jowar*, oats, gram, cowpeas and sugarcane. A number of manurial investigations, particularly on rice, are in progress. Work is also being done on mixed farming units to compare the unit-acre production and the cost of production per acre and per maund when the units are intensively cultivated. Nucleus pedigree seeds of improved strains of crops, for distribution to the different States, are produced here on a large-scale.

Botanical Substation, Pusa

This Substation undertakes crop improvement work for north-eastern India. Crop collections which cannot be maintained at New Delhi, are grown here and investigations are conducted on problems of importance for this region, e.g., the breeding of wilt-resistant strains of *arhar* (pigeon pea). The substation also serves as an important centre for breeding rust-resistant wheats for this tract under the Co-ordinated Wheat-rust Control Scheme. Nucleus pedigree seeds of improved strains suitable for the region are multiplied and distributed to growers from here. The permanent manurial experiments, laid down when the main Institute was at Pusa, are being continued. The other Divisions of the Institute also conduct some of their experiments at this substation.

Other Substations

These include the substations at Simla, Indore, Pusa (Bihar), Wellington and Bhowali (Uttar Pradesh) which are devoted to wheat breeding work. At the substations at Simla, Poona and Kalimpong (West Bengal) work on plant viruses is in progress. Breeding of vegetables, especially European type vegetables, is carried out at the Central Vegetable Breeding Substation, Katrain (Kulu Valley).

EXTENSION WORK IN VILLAGES

Delhi Intensive Cultivation Scheme

Since 1949 the Institute is operating this scheme in a block of 19 villages situated in the western, predominantly *barani* tract of Delhi State. The programme of extension work includes the laying down of trials and demonstration plots on cultivators' fields with a view to impressing upon the growers the value and usefulness of improved varieties of crop plants and of scientific agricultural practices and farm implements. Practical demonstrations are also given in the different methods of plant protection and soil conservation.

Within the few years of inception of the scheme, gratifying results have been obtained and these have favourably impressed the farmers. About 1,330 demonstration-*cum*-trials with the 'New Pusa' varieties of wheat and other crops, fertilizer trials and demonstration of disease and pest control were conducted in these villages during the past years. The consistently outstanding performances given by the wheat variety N.P. 718, barley N.P. 13,oats N.P. 1, gram N.P. 58, peas N.P. 29, the hookah tobacco varieties N.P. 219 and N.P. 220, the sweet potato variety ' Pusa Safaid ' and the tomato variety ' Sioux ', have made them very popular in the tract. To mention the case of wheat alone, about 6,000 maunds of seed of the variety N.P. 718 are estimated to have been produced in these villages, several hundred maunds of which were sold as seed by the farmers to indentors from distant States like Rajasthan, Orissa and Madhya Bharat. It is intended to saturate these villages with improved varieties of different crops. The fertilizer tests conducted have helped the farmers to become fertilizer-minded.

POST-GRADUATE TRAINING

Courses leading to the Diploma of Associateship of the Institute

The facilities of post-graduate training offered by the Institute are probably the best of their kind available in India today. These facilities are being considerably expanded with active co-operation of the Rockefeller Foundation.

The session commences on the first of October each year and about 90 students are admitted. The first year of the two-year training is devoted to intensive instructional work, theoretical as well as practical, and culminates in the Preliminary Diploma Examination. On qualifying in this examination, the trainee undertakes, during the second year, a research investigation in the field of his subject of specialistion and submits a thesis embodying the results obtained ; during this year, he also attends advanced lectures in his special subject. On the approval of the thesis and after successfully undergoing an oral examination, the candidate qualifies for the award of the Diploma of Associateship of the Institute.

Two-year post-graduate courses are provided in the following subjects :

(i) Agricultural Botany—with specialisation in the second year in (a) plant breeding and genetics, (b) cytogenetics, (c) crop physiology, (d) genetics and plant breeding (sugarcane), and (e) genetics and plant breeding (rice).

(ii) Soil science and agricultural chemistry—with specialisation in the second year in (a) agricultural chemistry, (b) soil colloids and clay minerals, (c) soil micro-biology, and (d) soil survey and land utilisation.

(iii) Entomology—with specialisation in the second year in (a) systematic entomology, (b) insect ecology, (c) insect toxicology, and (d) parasitology.

(iv) Mycology and plant pathology—with specialisation in the second year in (a) plant pathology, (b) systematic mycology, (c) viruses, and (d) plant bacteriology.

(v) Agronomy—sugarcane agronomy, or rice agronomy.

Training in agricultural engineering and horticulture will be commenced as soon as facilities become available.

The large and well-appointed post-graduate students' hostel has accommodation for 200 students.

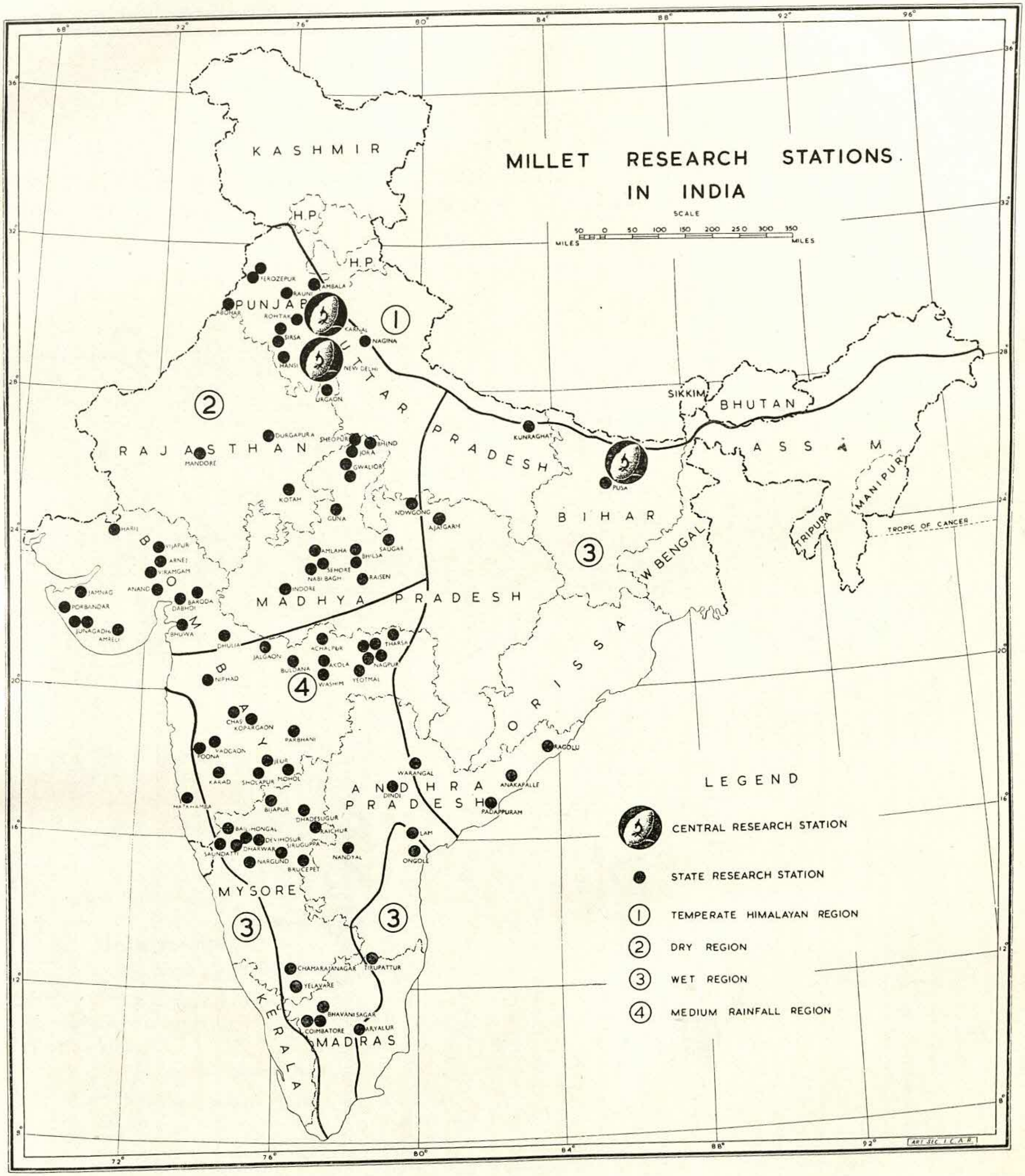
Short courses

Facilities are also provided for refresher courses or short training in any particular subject. A one-year post-graduate course in plant protection, commencing on the first of October each year, is offered ; in addition, a three-month refresher course in the same subject, starting on the first of November each year, is also held for the employees of the State Departments of Agriculture deputed for the purpose. Also provided, for candidates similarly deputed, is a six-month course of post-graduate training in soil survey and land utilisation.

Honorary research workers and Research Fellowships

The Institute having been recognised by many Universities in India as a place where the alumni can work for doctorate degrees, facilities are offered to *bona fide* research workers for carrying out research, provided laboratory accommodation is available, and guidance and supervision of the work is arranged for.

The Prospectus of Facilities for Training at the Institute can be had from the Manager of Publications, Government of India, Civil Lines, Delhi, on payment of annas ten per copy.


MILLET RESEARCH STATIONS IN INDIA
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UTTAR PRADESH
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ANDHRA PRADESH
MYSORE
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NEW DELHI
URGAON
DURGAPURA
SHEOPUR
BHIND
MANDORE
JORA
GWALIOR
KOTAH
GUNA
NOWGONG
AJAIGARH
KUNRAGHAT
PUSA
SAUGAR
AMLAHA
BHILSA
SEHORE
NABI BAGH
RAISEN
INDORE
HARIJ
VIJAPUR
ARNEJ
VIRAMGAM
ANAND
JAMNAG
BARODA
DABHOI
PORBANDAR
JUNAGADH
AMRELI
BHUWA
DHULIA
JALGAON
ACHALPUR
THARSA
NAGPUR
BULDANA
AKOLA
WASHIM
YEOTMAL
NIFHAD
CHAS
KOPARGAON
PARBHANI
POONA
VADGAON
JEUR
KARAD
SHOLAPUR
MOHOL
WARANGAL
RAGOLU
DINDI
ANAKAPALLE
HATKHAMBA
BIJAPUR
PADAPPURAM
DHADESUGUR
BAILHONGAL
RAICHUR
DEVIHOSUR
SAUNDATTI
DHARWAR
SIRUGUPPA
NARGUND
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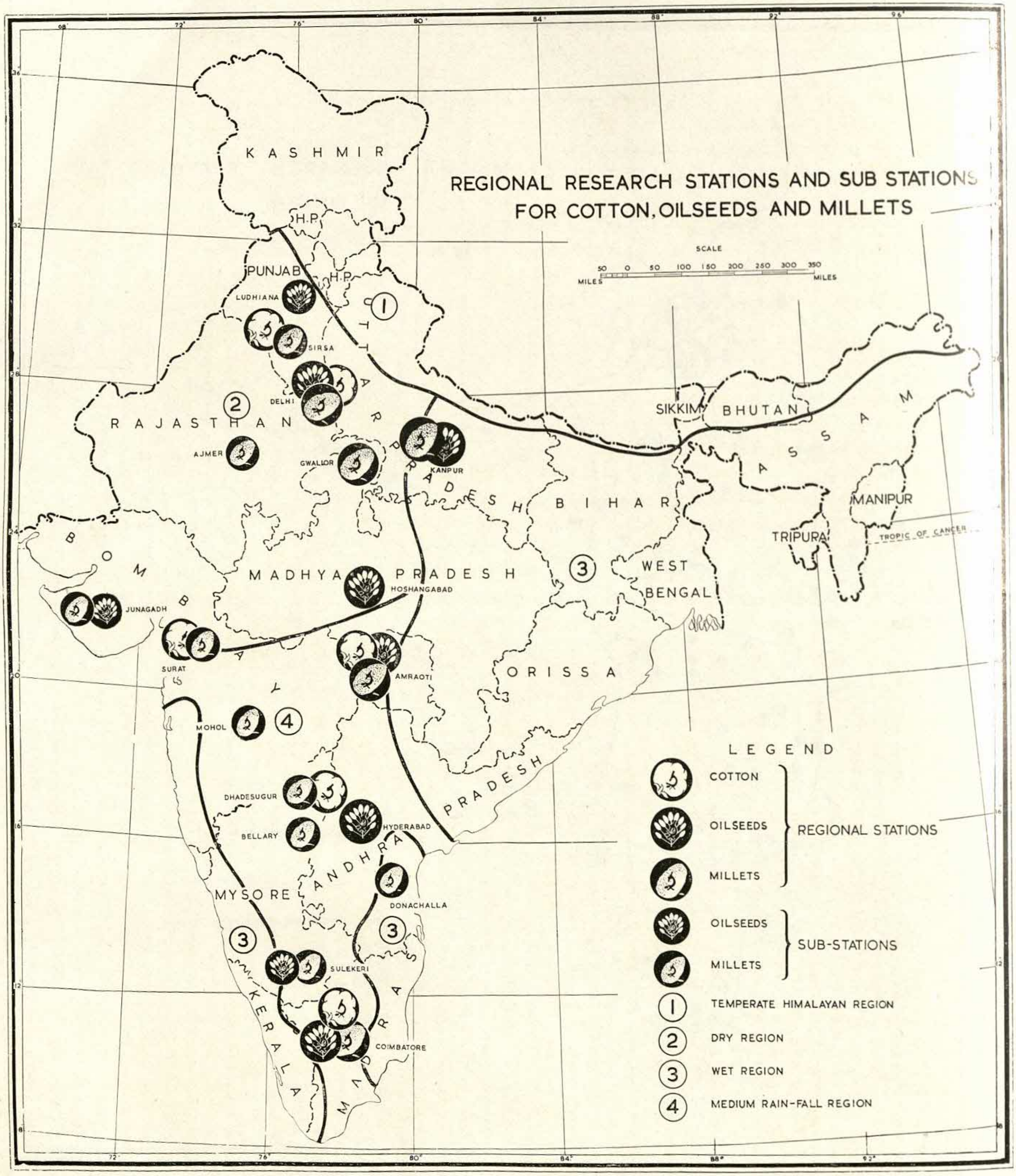


REGIONAL RESEARCH STATIONS AND SUB STATIONS FOR COTTON, OILSEEDS AND MILLETS

COMPOSITE REGIONAL STATIONS FOR COTTON, OILSEEDS AND MILLETS

THE need for intensification of the programmes of agricultural research on important crops like cotton, oilseeds and millets has been felt during the past few years. It, therefore, became imperative for the respective commodity Committees and the Indian Council of Agricultural Research to formulate plans for proper orientation of research in cotton, oilseeds and millets.

It was realised that a vast country like India with marked variations in soil-climate complex, research on crops like cotton, oilseeds and millets, which are grown in rotation under rainfed conditions, must essentially be regional in character. A single central research station for a single commodity could not be expected to solve the various problems connected with these crops.

In 1954, the Indian Central Cotton Committee decided to regionalise research in cotton and a sum of Rs. 10 lakhs was provided in the Second Five-Year Plan for the establishment of regional stations for research on cotton on variety-*cum*-climate basis. The Indian Council of Agricultural Research convened a conference of research workers on millets in 1954, and one of the recommendations of this Conference was to organise research on millets on regional basis. The Indian Central Oilseeds Committee also subsequently accepted the concept of regionalisation of research in oilseeds. In order to give a practical shape to these recommendations, a Sub-Committee was appointed in 1956 to consider the propriety of establishing cross commodity research stations for investigations on cotton, oilseeds and millets.

This Sub-Committee recommended establishment of 17 composite regional stations spread over the entire country for work on cotton, oilseeds, castor, groundnut, *Brassica*, sesamum, *toria* and *taramira* and millets (*jowar* and *bajra*) with a view to organise research on a cross-commodity basis, and in a manner which would ensure maximum efficiency coupled with economy in expenditure.

The Indian Central Cotton Committee, Indian Central Oilseeds Committee and Indian Council of Agricultural Research have accepted these recommendations and have initiated steps to implement the same. A further integration of work on millets with that on maize is contemplated by establishing a composite station for *bajra* and maize at Ajmer.

The details relating to the location and scope of work of the different regional stations are given below:

Location	*Main station*	*Substation*
1. Coimbatore	Cotton, groundnut and *bajra*	—
2. Dhadesgur	Cotton	*Jowar*
3. Shantisagar (near Honnali)	—	*Ragi* and groundnut
4. Bellary	—	*Jowar* (*rabi*)
5. Dronachallam (or alternate site)	—	*Jowar* (*kharif*)
6. Mohol	—	*Jowar* (*rabi*)
7. Hyderabad (Rajendrasagar)	Castor and groundnut	—
8. Amravati	Cotton and *jowar*	groundnut
9. Surat	Cotton	*Jowar*

Location	Main station	Substation
10. Junagadh	—	Groundnut and *jowar*
11. Hoshangabad	—	Linseed
12. Ajmer	—	*Bajra*
13. Gwalior	—	*Jowar* (*kharif*)
14. Kanpur	*Sarson*, and *bajra*	—
15. Sirsa	Cotton	*Bajra*
16. Ludhiana	*Toria* and *taramira*	—
17. I.A.R.I, New Delhi	Cotton, *jowar*, *bajra*, and linseed	—

The essential pattern of the project is to provide a coverage for comprehensive research work on these crops as conditioned by a wide range of agro-climatic variations in the country. Each main station is expected to develop into a more or less full-fledged agricultural research institute offering facilities for research on various aspects of improvement and production of the selected crops in the region. A major research programme at the Indian Agricultural Research Institute, New Delhi would consist of fundamental work on cyto-genetics and physiology of cotton, linseed, *jowar* and *bajra* ; it would also include breeding of linseed with a view to evolving varieties suitable for the northern alluvial plains.

These research stations with the exception of the Indian Agricultural Research Institute would function under the administrative control of the Government of the States in which they happen to be located. A Regional Committee will be set up in each region to formulate a comprehensive research programme for the region as a whole, and assign various items of work to different stations located in the region. This Regional Committee would consist of (i) the Agricultural Commissioner with the Government of India, (ii) the Directors of Agriculture of the States included in the region, (iii) the Director of the Indian Agricultural Research Institute, New Delhi and the Head of the Division of Botany,Indian Agricultural Research Institute (for regional stations at Sirsa, Ludhiana, Kanpur and New Delhi), (iv) the Secretary, Indian Central Cotton Committee, (v) the Secretary, Indian Central Oilseeds Committee, (vi) the Chief of the Regional Station concerned and (vii) Specialists dealing with cotton, oilseeds and millets of the States constituting the region.

It will be the responsibility of the chief of a regional station to prepare a detailed programme of research work for the whole region. This would be considered by the Regional Committee concerned. The Regional Committees would meet once a year at a suitable place in each region. The chief of a composite regional station would be expected to provide technical guidance to the substations under it and the State research stations located in the region.

ORGANISATION AND FINANCE

Each main regional station, except the Indian Agricultural Research Institute, New Delhi, would be under the overall charge of a senior scientist and would have fully equipped Sections of (i) Plant Breeding and Genetics, (ii) Agronomy, (iii) Agricultural Chemistry and Soil Science, (iv) Plant Pathology and (v) Entomology, each of which will be headed by a specialist. Besides these, each station would have the usual quota of statistical and technological assistants, artists and other ministerial staff. The substations would be under the supervision of experienced plant breeders.

The cost of running these seventeen regional stations for the first five years is estimated to be Rs. 72,77,566 of which Rs. 60,02,563 represent the recurring expenditure for staff and contingencies and Rs. 12,75,000 for non-recurring expenditure for buildings and equipment. The entire amount is to be shared by the Indian Central Cotton Committee, Indian Central Oilseeds Committee and the Indian Council of Agricultural Research in the proportion of 2 :2 :1 respectively.

CENTRAL RICE RESEARCH INSTITUTE

Cuttack (Orissa)

THE Central Rice Research Institute located at Cuttack in one of the main rice growing tracts of India, was established in 1946 to undertake fundamental research in all aspects of the rice crop, to investigate such problems as have wide application, and to act as a centre for authoritative information on the crop. During the 10 years of its existence, the Institute has produced results of practical value for use in the drive for increasing production in the country. The Institute has established a reputation in rice research in India and outside in South-East Asian countries, which are increasingly making use of the Institute for obtaining technical information and for training of their men. The F.A.O. entrusted the execution of their International Rice Breeding Project to the Institute and twice, once in 1952 and again in 1955 held the International Training Course on Rice Breeding in collaboration with the Institute. The Institute is one of the world centres recognised by the F.A.O. under their project for maintenance of genetic stocks registered by the rice growing countries with the F.A.O. and the Director of the Institute has been invested wih over-all supervision of this project.

The Institute is organised in Research Divisions of Botany, Agronomy, Statistics, Agricultural Chemistry, Agricultural Entomology and Plant Pathology and two new Divisions, that of Agricultural Engineering and Crop Physiology, are being started so as to cover all aspects of rice research. There is also a Farm Division to look after the farm management and extension work in the Intensive Cultivation Centre, covering some 8,000 acres attached to the Institute. The research programme in various branches is aimed at enabling the country to produce more and better rice and both short and long term research projects based on this objective are undertaken. Apart from research projects, the Institute also imparts post-graduate training of highest standard in different branches of rice research and holds periodical Refresher Courses and Farmer's Training Classes to demonstrate to extension staff and the farmers the results of rice research achieved.

History

Scientific research on the improvement of rice, the most important food crop of the country, was started in India some 45 years ago. Breeding work started first in Bengal in 1911, followed by Madras almost immediately afterwards and gradually spread to other rice growing States. Attention to agronomic and manurial practices to push up crop yields was also paid. Recognising the importance of the crop in the economy of the nation and the need to stimulate rice research in the country, the Indian Council of Agricultural Research since its inception in 1929 has sponsored major breeding and research projects for improvement of the crop in various States.

The production of rice in the country has, however, been invariably short of requirements. The Central Government, in view of this and the need for intensifying research on all aspects of this crop, contemplated in 1944 to set up a Central Rice Committee by levying a cess on rice on the same lines as on jute and cotton and to utilise the funds thus raised for furthering rice research. There were, however, objections in the country to the levying of a cess on a food crop, and the institution of a separate commodity committee for rice was, therefore, abandoned. The Central Government then decided to set up a central institution for intensifying research on all aspects of rice improvement and established the Central Rice Research Institute in 1946 with Dr. K. Ramiah as its first Director.

The area of the Institute covers 250 acres of land. Originally the organisation of research on rice crop was planned to develop a Central Station at Cuttack with a number of regional substations for study of special problems of all-India importance but the development of the Institute, its buildings, laboratories and substations had to be kept in abeyance because of the partition of the country.

The building programme of the Institute has now been taken up since 1954-55 as a part of the First and Second Five-Year Plans in the development of research in the agricultural sector. The establishment of a substation on problems of saline resistance has also been sanctioned.

BOTANY DIVISION

The main object of work in the Division is to increase production per acre and with this view, investigations on breeding, genetics and cytology of the rice crop are undertaken. The Division has assembled an extensive collection of over 3,000 genetic stocks from all over the world.

The collection is being studied and sifted for yield, early maturity, non-lodging and other desirable characters, for introduction of varieties for exploiting inbreeding projects, for supplying material to the States and other rice growing countries and for the study of the genetics of the crop. A large number of requests for supply of seed material from workers both in India and abroad is complied with every year. The survey of Jeypore tract in Orissa, which is considered as a secondary centre of origin of rice has recently been started under an I.C.A.R. sponsored scheme with a view to obtaining suitable breeding material, and some very interesting material of wide variability has been collected for study. Among breeding projects in progress, breeding of (a) high-yielding strains responsive to heavy fertilisation, (b) early maturing and high-yielding strains, (c) disease-resistant strains, (d) non-lodging strains, and (e) fine quality rice may be mentioned.

A comprehensive and intensive hybridisation programme between the *japonica* and *indica* groups of rice, sponsored at the Institute both by the I.C.A.R. and F.A.O. for the benefit of Indian States and South-East Asian countries respectively, to evolve rice strains combining the *japonica* characters of high yield and good response to heavy fertilisation with hardiness and adaptation to tropical conditions, characteristic of *indicas* was completed this year (1956). Under this scheme, over 700 *japonica-indica* cross combinations were made and seeds from the hybrids have been distributed to participating States and foreign countries for their breeding work.

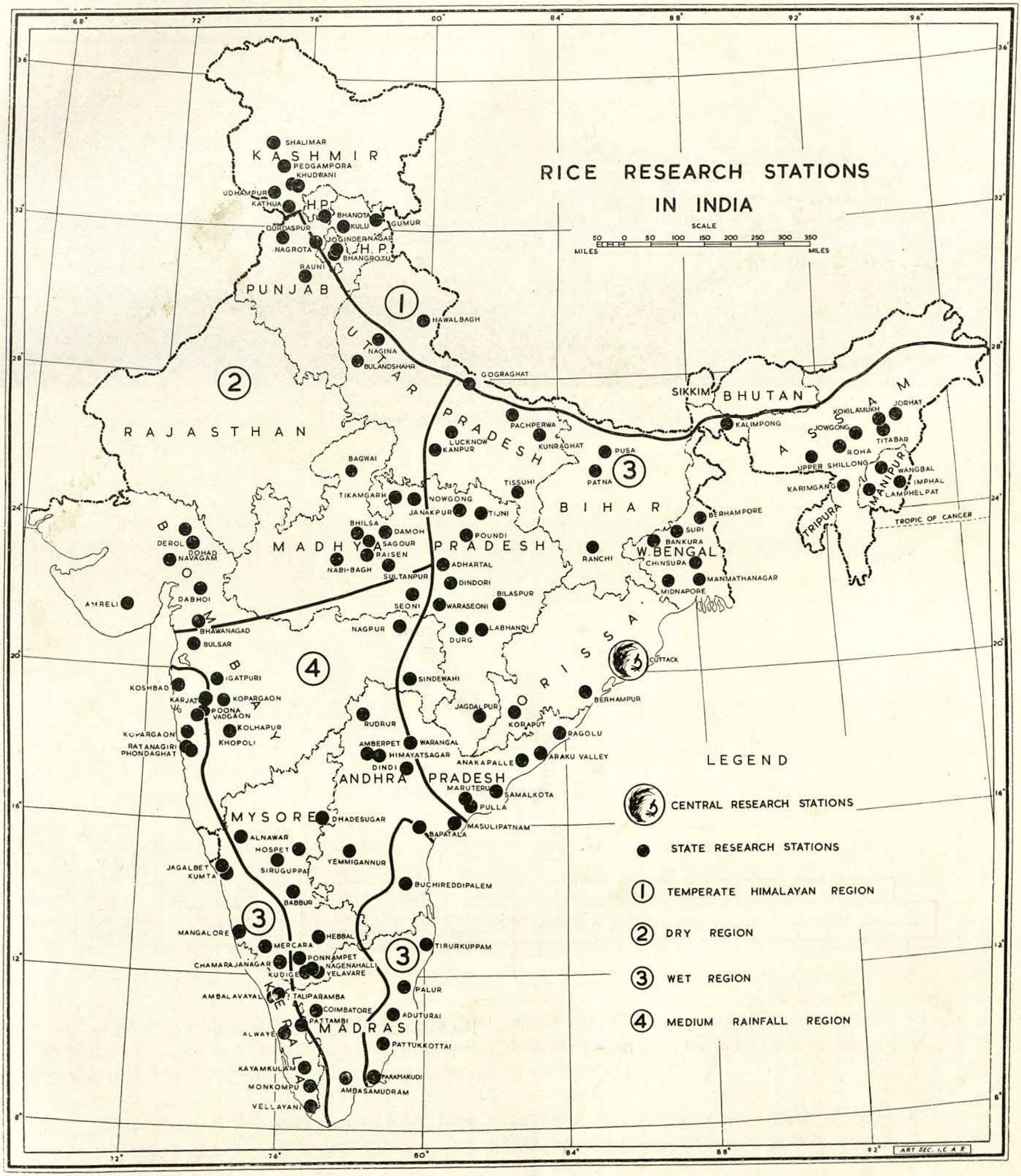
Fundamental studies are in progress on the inheritance and linkage relationship of several characters, sterility in interspecific and inter-racial hybrids, species relationship, origin of rice and use of embryo culture for raising inter-specific hybrids.

AGRONOMY DIVISION

Agronomic work is aimed at improvement of cultivation practices, soil management, crop sequence and manurial and cultural schedules with a view to increasing production and to get maximum economic return for the cultivator. Short and long term projects with respect to varietal and fertilizer trials, green manuring and cultural practices are undertaken.

Varietal trials

Trials of Indian and foreign varieties and new promising selections are undertaken to determine their suitability, performances and response to different manurial and cultural

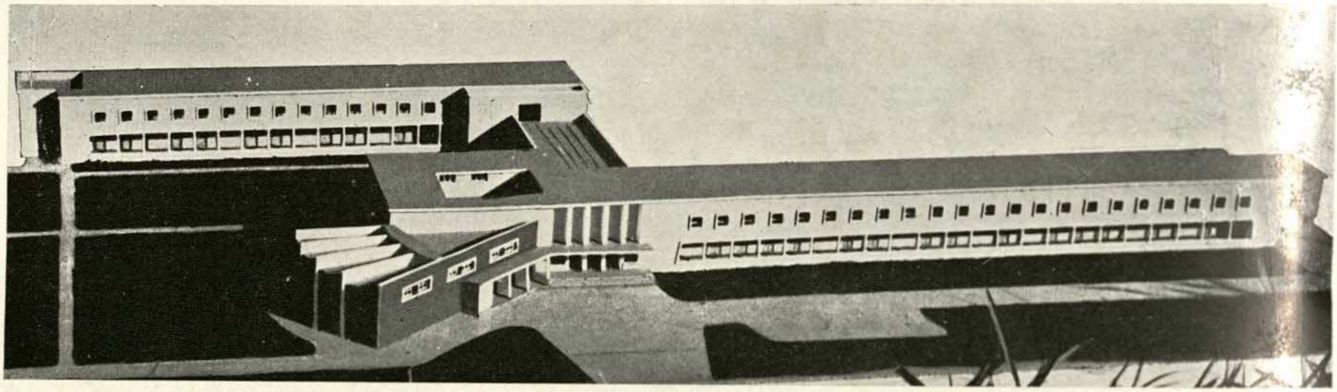


RICE RESEARCH STATIONS IN INDIA

LEGEND

- CENTRAL RESEARCH STATIONS
- ● STATE RESEARCH STATIONS
- ① TEMPERATE HIMALAYAN REGION
- ② DRY REGION
- ③ WET REGION
- ④ MEDIUM RAINFALL REGION

PLATE XV]

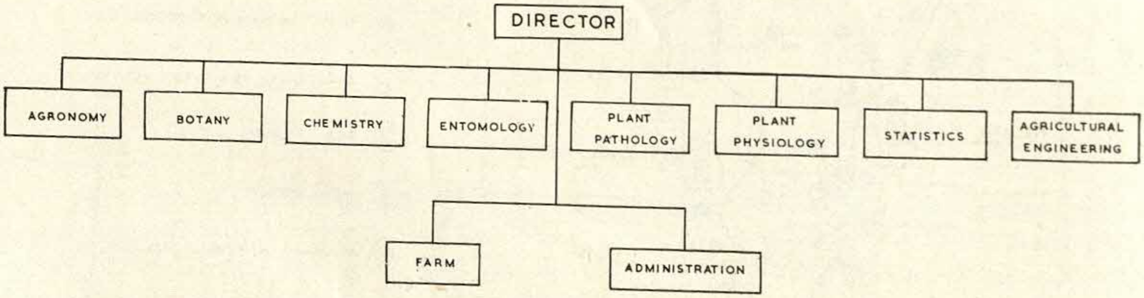


Central Rice Research Institute, Cuttack

CENTRAL RICE RESEARCH INSTITUTE

Cuttack (Orissa)

Organisation Chart



practices. Co-ordinated varietal trials in different rice growing areas to determine the suitability of varieties found promising at Cuttack under diverse climatic conditions in the country are also in progress.

Manurial trials

Investigations on the optimum and economic dose of nitrogenous fertilizers, comparative efficiency of organic manure and inorganic fertilizers for increasing production, methods and time of application of different fertilizers and study of cumulative and residual effect of fertilizers on productivity are in progress.

The suitability of different green manuring crops, collected from rice growing countries all over the world, is being determined for growing in rice fields, and the proper time of sowing and incorporating the green manure crop in soil are being investigated under a scheme sponsored by the I.C.A.R. The number of green manuring crops under study is 63 at present.

Cultural investigations

The suitability of growing groundnut, cotton, wheat, gram, oil seeds, etc. in crop sequence with rice is under investigation and growing two or three crops of rice or jute followed by rice is under trial. Some promising results have been achieved in respect of crop sequence trials.

The effect of time of planting, spacing, inter-culturing and inter-cropping on yield of rice crop and the efficiency of different selective herbicides in controlling rice weeds, their dosage and time of spraying are under study.

Co-operative trials

Co-operative trials on the feasibility of growing crops like wheat, oil seeds, etc. under soil and climatic conditions in rice areas are being investigated in co-operation with the Indian Agricultural Research Institute.

STATISTICAL DIVISION

This Division deals with different aspects of field plot technique to help layout of field trials in order to get and assess the desired information correctly. With this view, the relative efficiency of different layouts, effect of size, shape and number of plots on the co-efficient of variation both in planted and broadcast crop is being studied. Sampling technique for assessing yields, damage by pests and diseases, and for crop nutritional studies are employed. Developmental and correlation studies to establish relationship of various plant attributes with yield have been taken up.

AGRICULTURAL CHEMISTRY DIVISION

The principal object of this Division is to study the behaviour of water-logged soil state in relation to crop production and carry out investigations on the chemistry of crop nutrition, which will help in increasing yield and quality of rice in the country. With this view, systematic investigations on chemical and physical properties of water-logged rice soils are undertaken to trace changes in nutrient availability. The work on nitrogen and phosphate changes in water-logged state is in progress and some useful results have been achieved.

Fundamental investigations are in progress on seasonal growth and uptake of nutrients by varieties of different durations to determine the nature of uptake during the life history of a plant in order to determine the requirements and time of application of the fertilizer.

Recently, water culture studies have been undertaken to investigate the chemical aspects of nutrition, requirements of different elements, the efficiency of different elements in inducing tillers and in formation of grain. Differential behaviour of varieties of various duration is also under investigation.

Rapid methods of soil analysis, and tissue tests suited to water-logged conditions of rice crop are being standardised.

ENTOMOLOGY DIVISION

Work in this Division is directed towards fundamental studies on the pests of rice with the ultimate object of increasing rice production.

The relative resistance of varieties to pests, and the correlation of morphological and anatomical characters of the rice plant with pest resistance is under investigation with a view to evolve resistant varieties. No common method has yet been devised to estimate the losses due to insect damage. Work on the estimation of the incidence of pests and losses to the crop caused by pests is in progress. Studies have also been undertaken on the efficiency of sampling techniques for estimating pest incidence and losses to the crop.

Meteorological conditions and the consequent cultural practices limit the outbreak of pests to certain zones and the abundance of pests is largely governed by by climatic factors. The correlation of crop weather data with the pest incidence and the seasonal distribution of pests will help to forecast the outbreak of pests, so that a timely warning may be issued for the control of pests.

The different formulations of insecticides are being tested to determine the dose, time and method of application and their efficacy in controlling different rice pests.

Several indigenous plant products are known to possess insecticidal properties and, the utilisation of such products as insecticides is under study.

Critical information on the life history and alternate hosts of important pests in which there exists lacuna in the present state of knowledge is being collected.

The estimation of losses of grain during storage, different grades of rice and their susceptibility to pests, grain storage structures suitable for rice and different methods of control of grain pests by indigenous and chemical insecticides are under investigation.

PLANT PATHOLOGY DIVISION

The activities of this Division are directed towards the study and control of rice diseases with special reference to blast and *Helminthosporium*. It is estimated that these two diseases along with others like stem-rot and foot-rot cause annually about 10 to 15 per cent loss in yield in the country.

The programme of work in this Division includes studies on the origin and spread of diseases with special reference to sources of infection, viability of the pathogens and factors favouring their development on a large-scale with the ultimate object of forecasting disease outbreaks. Control of the diseases is attempted through isolation of resistant varieties, evolving new resistant varieties by hybridisation, and also by working out suitable economic spraying schedules with fungicides.

Techniques of artificial infection and evaluation of resistance of varieties were evolved and the vast genic reservoir in the genetic stocks collection of the Institute is being utilised to isolate resistant genes.

A method for obtaining an objective and reliable estimate of the loss caused by the diseases is being studied.

The effect of treating rice seeds with fungicides on their viability in storage, germination, stand and yield of rice in special relation to the control of different seed-borne infections are under study.

An international blast varietal susceptibility trial is under way in which the several participating countries in the world are testing, under conditions obtaining in the respective countries, varieties which have been found resistant to blast in the different countries.

FARM DIVISION

The Farm Division looks after the management and cultivation of the farm.

The maintenance of purity and multiplication of seed of improved varieties is done on large-scale and the seed is supplied to Orissa Department of Agriculture for distribution.

The cultural and manurial practices recommended by the research divisions are tested on a bulk-scale in the farm area.

The Division also brings to the notice of the cultivators, the results of practical value achieved at the Institute, and helps them to make use of these in increasing production from their land. This is carried out in an intensive cultivation area of about 8,000 acres situated in the neighbourhood of the Institute. Here, use of improved methods of cultivation, improved varieties, green manuring practices, use of fertilizers, methods of pests and disease control, growing of second crop of rice are popularised by actual demonstration on the cultivators' fields. Working parties from the Institute visit this centre regularly and advise cultivators on methods of increased production and render timely help in combating diseases and pests. Apart from this, district trials with varieties and manures are being conducted in the Intensive Cultivation Centre.

TRAINING

The country needs a large number of trained personnel in the field of rice cultivation and improvement. This Institute helps in this by training post-graduate students and running Refresher and Farmers' Training classes.

Post-graduate training was started in 1954 for students from the Indian Agricultural Research Institute qualifying for the Associateship, who specialise in rice. One years' post-graduate research-*cum* training course in the field of rice botany and rice agronomy is at present given. With additional facilities available in the near furture, this will be extended to other branches of rice research.

Post-graduate work in rice research is also open to foreign students and research scholars from Thailand and Japan have availed of the facilities in the field of plant breeding and crop nutrition.

The Institute is recognised by F.A.O. as the Centre for their International Course on Rice Breeding. The first training course was held in 1952 and the second in 1955.

The Refresher Courses are given periodically for the benefit of Extension Officers of Orissa Department of Agriculture. These officers take the course in 3-4 sessions during the crop season, when results of research are brought to their notice by actual field demonstrations, lectures and group discussions. Practical training is also imparted to cultivators from the Intensive Cultivation Centre attached to the Institute, who come and work at the farm for short periods and get acquainted with improved cultivation practices.

ACHIEVEMENTS

Breeding. The study of genetic stocks has brought to light some high-yielding varieties which are now under large-scale test. Some promising varieties of Chinese origin, found to be early maturing and high yielding at Cuttack are being tested in a number of Indian States. A fine grained selection, named J. 192 evolved at the Institute has been found very promising for the second crop season in Tanjore deltaic areas of Madras State. Some varieties from Taiwan, introduced by the Institute in Kashmir, are reported to be promising and are being further tested.

The *japonica* × *indica* Hybridisation Projects sponsored by the I.C.A.R. and F.A.O. were completed this year and over 40 lakh seeds for growing F_2 and subsequent generations have been distributed to the several Indian States and South-East Asian countries for breeding strains suited to their environments. Good progress has also been made at this Institute in evolving high-yielding strains from *japonica* × *indica* cross combinations. The mean single plant yield of some selections now in F_5 generation was 50-100 per cent higher than the mean single plant yield of *indica* parents. These selections are very promising and are being further studied. It has been found that the spikelet sterility of varying degrees observed in the *japonica-indica* hybrids was no handicap in breeding work, as good worthwhile fertile selections are equally obtainable from populations derived from highly sterile hybrids as from more fertile hybrids.

The high yielding early maturing selections made in crosses between late maturing, high yielding and early maturing *indica* varieties are very promising and are now in an advanced stage of breeding. These selections are about one month earlier than the high yielding parents, and are good from the yield point of view also.

The role and inter-relationship of genes governing anthocyanin pigmentation in the leaf blade and other parts of the rice plant have been determined, and the inheritance of notched kernel and rudimentary auricle studied.

Work projects

Manuring and cultural practices. Intensive studies have been undertaken during the last 10 years on the comparative efficiency of various nitrogenous fertilizers. The time, method, economic dose and effect of continuous application of fertilizers have been examined. On an equal nitrogen basis, organic manures like oilcake and green manure give the same response as ammonium sulphate, and the optimum dose of nitrogen application varies from 20 to 40 lb. nitrogen per acre; any application beyond this dose gives no corresponding increase in yield. Ammonium sulphate is by far the best fertilizer for rice, but ammonium phosphate, ammonium chloride and ammonium sulphate-nitrate are also equally good and can be used as alternative fertilizers. A continuous use of sulphate of ammonia on the same land for the last eight years has shown no deleterious effect in crop yield as yet. Regarding the mode of application of the fertilizer, it has been established that it is more profitable to apply ammonium sulphate in the sub-surface zone 2-3 in. deep in dry soil conditions immediately before flooding, or in the form of pellets after planting, rather than broadcast it on the surface of wet soils as is commonly practised by the cultivators. It has been found that no additional fertilizer is necessary, if a green manuring crop growing *in situ* giving a supply of 4000-5000 lb. of green matter is incorporated in the field at puddling.

Soaking of rice seed in 10-20 per cent solution of dibasic potassium phosphate for 24 hours and drying it prior to sowing gives a yield increase of 8-10 per cent over the control. Results have been confirmed from a number of trials on the cultivators' fields where an average response of 8 per cent increase in yield was obtained.

An important result that has been established and demonstrated on a large-scale on the cultivators' fields is the feasibility of growing two crops of rice in succession on the same land wherever irrigation facilities are available. Suitable varieties, like PTB.10 and MTU.15 are being recommended for the second crop season. Groundnut, cotton and gram when grown subsequent to rice have also been found to do well and give good returns to cultivators.

The control of weeds in rice fields, which is an important aspect of rice cultivation, has been attempted by spraying with selective herbicides. Phenoxylene 30 at 2/3 gallon per acre, sprayed six weeks after planting, is found to be as effective as hand weeding.

Soil and plant nutrition studies. The study of behaviour of water-logged soil and nitrogen changes occurring in the water-logged state has shown that losses of nitrogen from the soil and from that of applied fertilizers occur because of oxidation and denitrification processes taking place in the upper and lower soil zones respectively. Under adverse conditions, these losses of nitrogen from applied sulphate of ammonia amount to about 30-40 per cent due to denitrification, and 10-20 per cent to surface drainage at the time of heavy rains. The losses can be avoided by sub-surface application of ammoniacal fertilizers in the water-logged state, and crop yields pushed up. Different methods of fertilizer application under diverse soil, water and cultivation conditions have been recommended.

The importance of drying the soil before cultivation in bringing about soil conditions leading to an increase in the ammonifying capacity of the soil and thus pushing up crop yields has been emphasised particularly in the Intensive Cultivation Area where two or more crops are grown on the same land in succession.

Lime at the rate of 1500-2000 lb. per acre has been found to have mineralising action on soil nitrogen in low-land rice soils, releasing an equivalent of 30-40 lb. of easily available extra nitrogen per acre and resulting in about 350-400 lb. of extra grain per acre. Investigations on the chemistry of crop nutrition, started recently, have shown interesting results regarding behaviour of *japonica* and *indica* rices under different nitrogen levels. Whereas *indica* rices give optimum yield at about 20 p.p.m. nitrogen, *japonica* rices continue to yield better even beyond 60 p.p.m. nitrogen.

Insect and pest control. Varietal susceptibility of 1500 varieties of genetic stock collections was investigated. Studies on the incidence of gall-fly in relation to the morphological and genetic characters of varieties indicated that green non-scented varieties were more susceptible than either green scented or purple pigmented varieties. Similarly it was observed that scented varieties were more suceptible to stem-borers than non-scented varieties. Awned varieties were less susceptible to stink bug than awnless varieties.

Work on determining accurate methods of estimating the incidence of pests and loss to crops showed that for every unit per cent increase in the incidence of gall-fly at its peak period of prevalence, there was 0.5 per cent decrease in yield. An increase of 1 per cent incidence of stem borer at the earhead stage of the crop resulted in decrease in yield by 0.6 per cent.

Depending on the weather conditions the peak period of incidence of gall-fly fluctuates between the end of September and end of November. Similarly the peak periods of prevalence of stem-borer are from October to November and February to April. Seasonal and climatic factors prevailing at the time of pest outbreaks are being recorded from year to year with a view to forecasting pest outbreaks.

Spraying 0.03 per cent Folidol to synchronise with brood emergence was found to be a very effective method of controlling the stem-borers and gall-fly, resulting in higher yields. It was found superior to spraying with chlorinated hydrocarbons like BHC or DDT. Dusting with 5 per cent BHC, 1 per cent Endrin or spraying 0.08 per cent Folidol or 0.2 per cent BHC was found to be effective against the minor pests. Some alternate hosts of the major pests of rice have been found. Four new parasites of a few major pests of rice have been discovered and described with a view to utilising them for biological control.

The investigation on the utilisation of plant products as insecticides has revealed that the power of the rhizomes of *Acorus calamus* is more effective than BHC or DDT formulations to control pests of stored grain.

Regarding the loss during storage on account of insect damage, it was found that raw rice was more susceptible to insect damage than parboiled rice. The grain moth, *Sitotraga cerealella* starts infesting the grains of the crop on the field itself.

Disease control. Methods of isolating varieties resistant to *Helminthosporium* and blast diseases of rice have been standardised and nearly 500 varieties have been tested. Fourteen varieties found resistant to blast and five to *Helminthosporium* in such tests are currently being tested at 46 different centres in India from where promising results have been obtained. An economic spray schedule for control of blast in the the field which costs only Rs. 10/- per acre for five sprayings in a season as against the usual cost of Rs. 50/- per acre has been worked out.

A formula for estimating the loss in yield caused by blast has been found out, according to which it has been estimated that every increase in neck infection by blast by 1 per cent is associated with approximately 0.9 per cent loss in yield.

Fungicides like Cuprocide, Phygon, Spergon, etc. were found to be effective in preserving the viability of rice seeds stored in moist and humid conditions.

Rice processing. A certain number of machines, both hand-worked and power-driven from Japan have been tested, and of these a pedal thresher and a small motor-driven thresher have been found to be more efficient and economical in use than the indigenous method of threshing rice by beating or cattle trampling.

FUTURE LINES OF WORK AND EXPANSION

The establishment of substations for dealing with special problems of rice improvement and cultivation, e.g. saline-resistant rices, flood-resistant and deep-water rices, hill rice of low and high altitudes is contemplated during the second Five-Year Plan. Of these the saline-resistant substation is expected to go into operation shortly.

The Agricultural Engineering Division is proposed to be added during the Second Five-Year Plan to study the scope of mechanisation in rice cultivation and appreciation of hand and bullock-drawn implements *versus* mechanisation. Simple implements for cultivation and threshing to ease the work of cultivation, and small power thresher and machinery for milling and polishing are intended to be designed.

Plant Physiology Section to investigate the physiology of nutrition in water-logged condition and to study photosynthesis and respiration in relation to critical growth stages is being organised.

An expansion of the Agricultural Chemistry Division is contemplated for intensifying studies on the chemistry of rice soils and nutritional requirements of rice crop with a view to increase production.

A parasite breeding laboratory is being set up to breed and multiply the parasites of the major pests of rice and to investigate the possibilities of biological control of these pests.

Studies on the meteorological data relating to the pests and disease outbreaks in rice crops in India have been planned to determine the factors governing the outbreak of pests and diseases with a view to forecasting such epidemics.

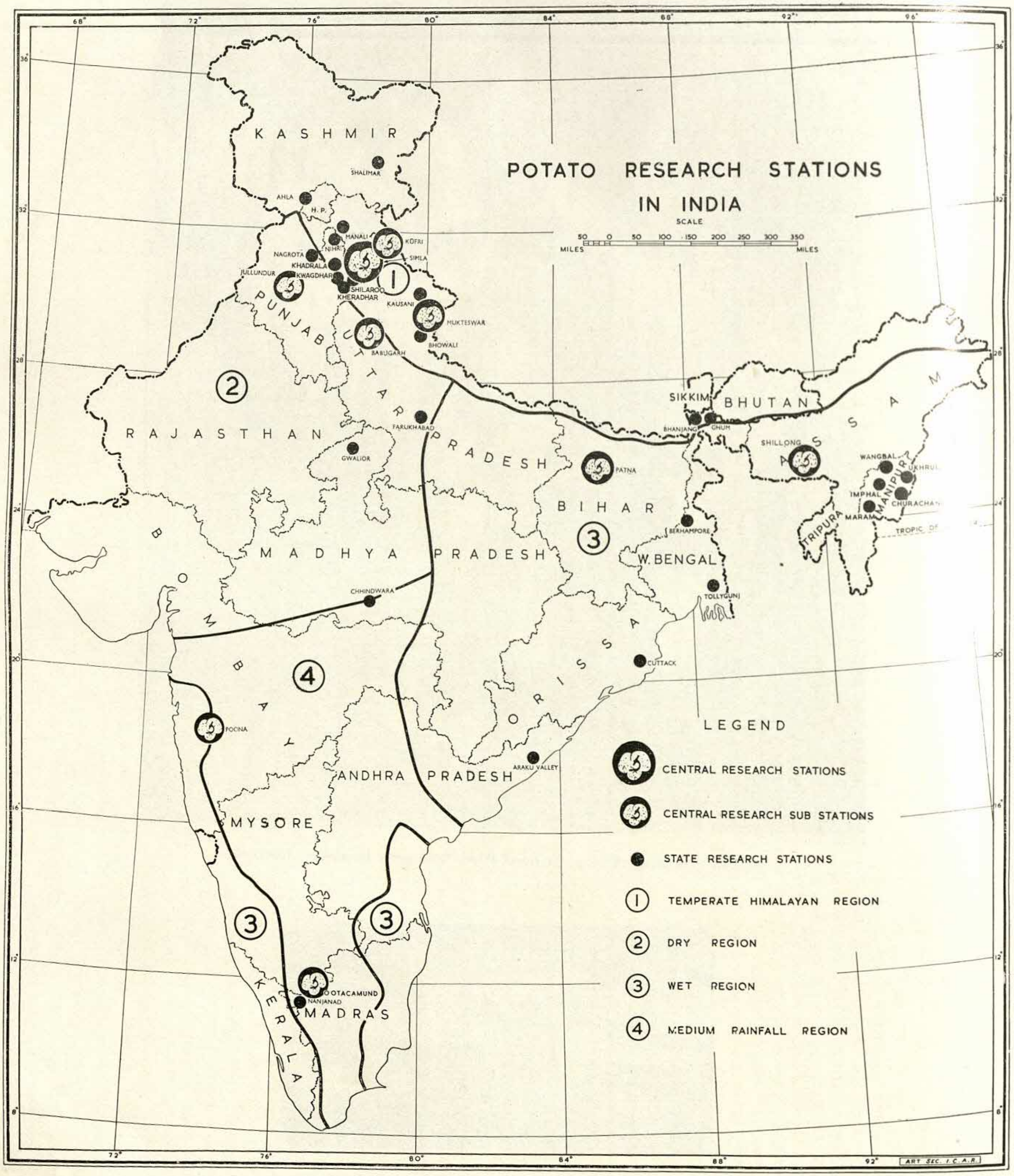
Investigations on stem-rot and physiological diseases of rice are contemplated.

For closer co-operation and co-ordination between the Institute and the rice growing States on problems of rice improvement and cultivation, liaison staff is proposed to be appointed in various States. This staff will carry the results of research at the Institute to the States with the object of testing these in environmental conditions prevailing therein, and help them in carrying out other items of work in their rice research programme.

Cross breeding of rice, Central Rice Research Institute, Cuttack

Hostel Building, Central Rice Research Institute, Cuttack

PLATE XVII]


POTATO RESEARCH STATIONS IN INDIA
SCALE
50 0 50 100 150 200 250 300 350
MILES
KASHMIR
SHALIMAR
AHLA
H. P.
MANALI
NIHRI
KUFRI
SIMLA
NAGROTA
KHADRALA
KWAGDHAR
JULLUNDUR
SHILAROO
KHERADHAR
KAUSANI
MUKTESWAR
BHOWALI
BABUGARH
PUNJAB
UTTAR PRADESH
RAJASTHAN
FARUKHABAD
GWALIOR
MADHYA PRADESH
CHHINDWARA
BOMBAY
POONA
ANDHRA PRADESH
MYSORE
OOTACAMUND
NANJANAD
MADRAS
KERALA
BIHAR
PATNA
W. BENGAL
BERHAMPORE
TOLLYGUNJ
ORISSA
CUTTACK
ARAKU VALLEY
SIKKIM
BHANJANG
GHUM
BHUTAN
ASSAM
SHILLONG
WANGBAL
UKHRUL
IMPHAL
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CENTRAL RESEARCH SUB STATIONS
STATE RESEARCH STATIONS
① TEMPERATE HIMALAYAN REGION
② DRY REGION
③ WET REGION
④ MEDIUM RAINFALL REGION
ART SEC. I.C.A.R.

CENTRAL POTATO RESEARCH INSTITUTE

Simla (Punjab)

IT was in 1932 that the potato entered the realm of scientific research in India when a small scheme for investigation of the physiology and genetics of the potato crop was initiated by the Indian Council of Agricultural Research at Nilgiris in Madras. Subsequently, the scheme for breeding potato varieties for northern India sponsored by the Indian Agricultural Research Institute was sanctioned in 1935, and the Potato Breeding Substation at Simla was established. Research stations were also opened in the hills at Bhowali and Kufri to strengthen various aspects of the investigations. The Madras scheme was closed down in 1938 ; while other projects continued functioning till 1949, when it was realised that piece-meal and *ad hoc* research could not yield results of practical value. Therefore, to extend and co-ordinate the various aspects of potato research, the Central Potato Research Institute, with its headquarters at Patna (recently shifted to Simla), was set up in August, 1949. This new Institute took over all the assets and work carried out under the several schemes of the Indian Agricultural Research Institute financed by the I.C.A.R.

ORGANISATION

The main Institute at Patna started with a 12·5-acre farm which was extended from time to time, and now comprises 65 acres. The four sections of the Institute, viz. Botany, Agronomy, Plant Pathology and Entomology started and continued work up to 1956 in temporary laboratory buildings at Patna. Breeding and virus research work was mainly carried out at its Simla and Kufri Stations.

The Expert Committee appointed by the Government of India to examine the working of the Institute, in their report published in 1954 made three major recommendations as below:

(1) That the research work connected with breeding of varieties should be regionalised and recommended setting up of a chain of regional stations for research in the principal potato growing tracts in the country;

(2) That the emphasis on the work, particularly breeding (which constitutes the major item of programme of work of the Institute) should be shifted from Patna to Simla;

(3) That steps should be taken to organise schemes for production of disease-free seed potatoes of different varieties in the hill regions.

These recommendations were accepted by the Government of India and the work of the Institute is being organised.

The Institute works through its several stations, which are either functioning or are being established.

Main Station, Simla-Kufri

Simla is the headquarters of the Director, and the main research station where work on botanical, cytogenetical and pathological aspects (including plant viruses) is being conducted. Additional facilities are being created shortly for work connected with physiological research and development of seed certification.

Activities carried out at the Simla Station extended to:

(*i*) maintenance and evaluation of breeding potentialities of a large collection of genetical stocks secured from within the country and imported from abroad,

(*ii*) the breeding of high yielding disease resistant varieties; their selection and trials in the plains and hilly regions of India, and

(*iii*) studies connected with virus and fungal diseases of potato.

The work of the Kufri Station (here conditions for spread of virus diseases are least favourable and nucleus disease-free stocks can be maintained with efficiency) is closely linked with the work of the Simla Station. At this Station the work is restricted to:

(*i*) maintenance of the nucleus foundation stocks of commercial varieties and hybrids,

(*ii*) production and maintenance of seedling progenies with a view to:

  (*a*) supplying annually seedlings of crosses for trials at the regional stations in the hills and plains of India, and

  (*b*) maintaining disease-free nucleus stocks of such varieties and hybrids which are likely to be of commercial value in the country.

Regional Station, Patna

The Botany, Agronomy, Plant Pathology and Entomology sections at this regional station tackle problems on different aspects of potato improvement with special reference to conditions in the plains. The major items of the programme of work are:

(*i*) evaluation of seedling progenies as varieties suited to conditions in the Patna region (disease-free stocks of these are annually sent from Simla and Kufri stations).

(*ii*) agronomical research connected with the determination of optimum standards of manuring, irrigation and cultivation, in relation to varietal and soil-climatic conditions of the region,

(*iii*) investigation and control of diseases and pests of potato in the plains, and

(*iv*) studies connected with potato storage.

Other Regional Stations

Besides the Patna Regional Station, five other regional stations are being set up immediately in the principal potato growing tracts of the country in:

(1) Uttar Pradesh (Hapur)
(2) West Bengal (Darjeeling)
(3) Punjab (Jullundur)
(4) Bombay (Poona)
(5) Madras (Nilgiris).

To begin with, the programme of work at these Stations will be restricted to

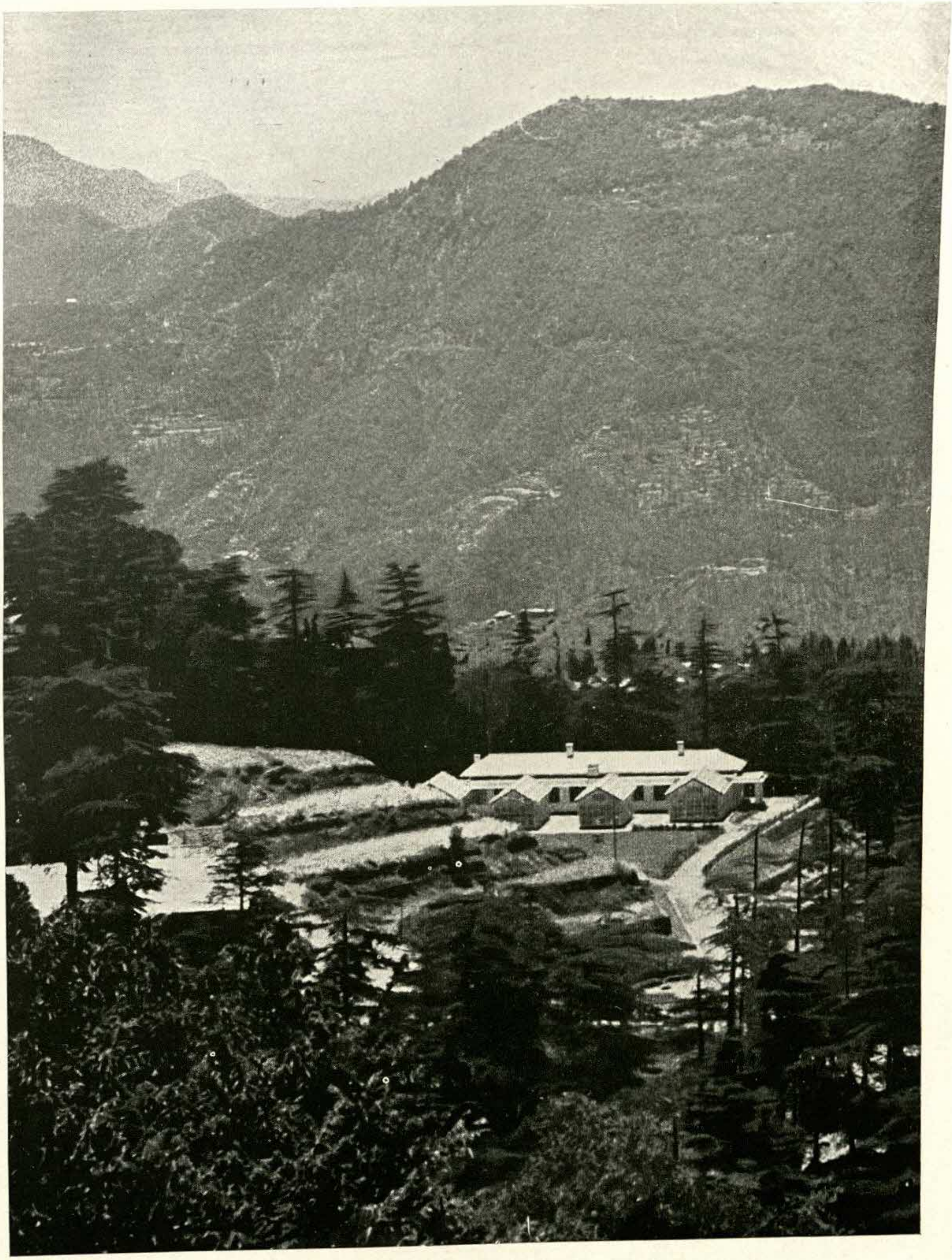
(*i*) selection and trials with seedlings with a view to find out their suitability as varieties for the region. (The seedling progenies are being annually sent in large numbers from the Simla-Kufri Station of the Institute),

(*ii*) determination of optimum standards of manuring, irrigation and cultivation in relation to variety and soil-climatic complex and

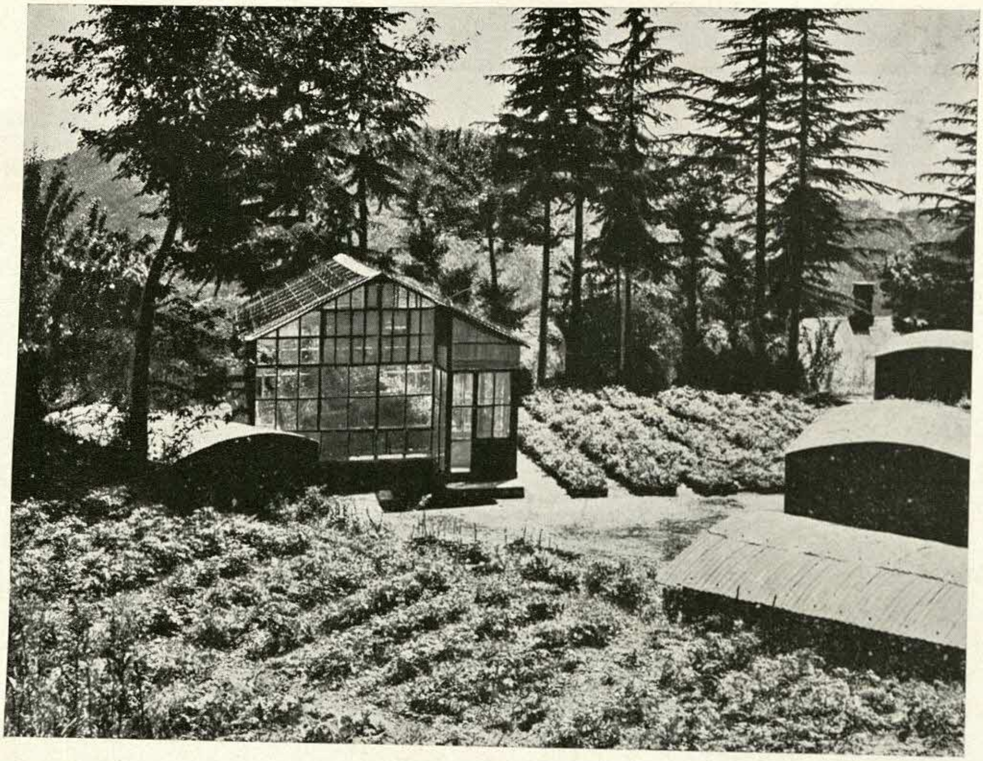
(*iii*) trials on the cultivators' fields with selected seedling progenies with a view to determine their adaptability for different sub-regional zones.

Besides the above programme at the Regional Stations, work on specific problems of the region will also be carried out.

[PLATE XVIII



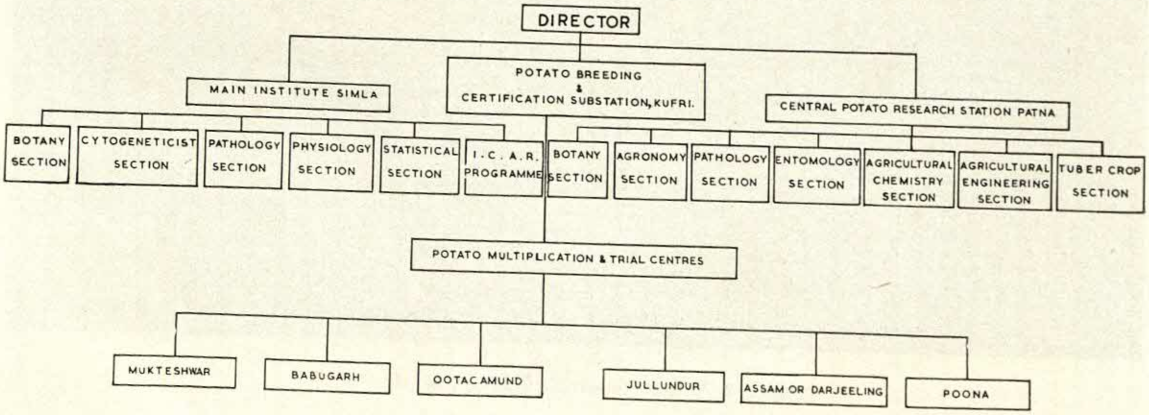
Central Potato Research Station, Simla



Plant Breeding Laboratory showing glass and control illumination houses, Central Potato Research Institute, Simla

CENTRAL POTATO RESEARCH INSTITUTE
Simla (Punjab)

Organisation Chart



Development work

A nucleus organisation has been recently set up to draw up plans and initiate, in co-operation with the State Departments of Agriculture, seed certification programmes for different regions particularly in the hills of India with a view to ensure purity and disease freedom of seed stocks of varieties grown in India. Facilities for multiplication of foundation seed stocks have been created in higher hills at Mukteswar.

Teaching and training

So far, no adequate facilities are available at the Institute for training in potato research and development. These facilities are being created and it is proposed to:

(*i*) organise post-graduate training courses in collaboration with the Indian Agricultural Research Institute,

(*ii*) organise one year's training course for the research and development workers in the country, and

(*iii*) organise extension courses for the benefit of the extension workers of the States.

ACHIEVEMENTS

The achievements given below are for the entire period of the potato work in the Institute.

BOTANICAL INVESTIGATIONS

As a result of study of the commercial potatoes grown in India, the varietal confusion which hitherto existed has been cleared ; varieties have been classified and synonymous stocks identified.

A large collection of the exotic commercial potatoes and South American wild and cultivated potatoes has been built up and their breeding value assessed.

The floral biology of several species has been investigated.

The causes of sterility have been established. The expression of self-and cross-incompatibility in several species of diploid *Solanums* has been found to be controlled by a single incompatability gene possessing a number of allelles of which 13 have been identified. On the basis of crossability studies, phylogenetic relationships within the diploid group ($2n=24$) of *Solanums* have been determined.

BREEDING INVESTIGATIONS

Several new high-yielding hybrids, like O. No. 45, Hybrid 208, 209 and 2236 which have been found to be very suitable for cultivation in north Indian plains have been evolved. O. Nos. 2186 and 2090 have been found to be promising for cultivation in the south Indian hills.

Disease-free stocks of Uptodate and Craig's Defiance built up at the Institute are being multiplied in the seed multiplication programme in the State of Himachal Pradesh. Steps are being taken to build up disease-free foundation stocks of new hybrids and other commercial varieties.

In relation to breeding for disease resistance, hybrids showing commercial potentialities and a high degree of resistance to late blight, charcoal rot and viruses X and Y have been built up.

Studies on propagation

A quick method of propagation of potatoes through the use of sprouts has been developed.

Agronomical studies

It has been determined that:

(*i*) nitrogen is the most important single manurial factor which influences yields. The magnitude of the response, however, depends upon irrigations and planting dates. Frequent irrigations to keep the soil moist, particularly during the tuberisation phase of the plant, yield the best results. Earlier planting and earlier application of nitrogenous fertilizers give a better response,

(*ii*) superphosphate in general gives a positive response on light sandy soils. In heavy soils in presence of heavy doses of farmyard manure, the response is not marked and there is usually very little increase in yield and

(*iii*) the response to potassic fertilizers has been found to vary with varieties. The foreign varieties which have been bred under high potassic levels, usually indicated a highly beneficial response to potassic fertilizers. However, the *Desi* varieties often showed little response to the potassic fertilizers. In red laterite soil, potassic fertilizer gave in general a better response.

Storage studies

Storage studies carried out under the local methods indicated that

(*i*) an early lifting of potatoes before the soil temperature rose sharply, greatly reduced the losses caused by charcoal rot in storage ;

(*ii*) there were marked varietal differences in keeping quality, and varieties which had good keeping quality were well preserved by country methods of storage ;

(*iii*) small-sized tubers had generally better keeping quality than the large-sized ones.

Physiological studies

A simple and inexpensive technique for breaking dormancy of potatoes through use of 1 per cent aqueous solution of thiourea has been developed.

Inhibition of sprouting

Methyl ester of nephthalene acetic acid is effective over a wide range of temperatures in inhibiting sprouting.

DISEASE STUDIES

The results of survey indicate that early blight, late blight, bacterial wilt, brown rot (caused by *Pseudomonas solanacearum*), charcoal rot and black scurf are the most important diseases in the hills and plains of India.

The survey of the virus diseases affecting the potato crop has shown that mosaic (caused by viruses Y, X and A singly or in combinations) and leaf roll are the most serious diseases responsible for degeneration of seed potatoes and consequent heavy reduction in yield.

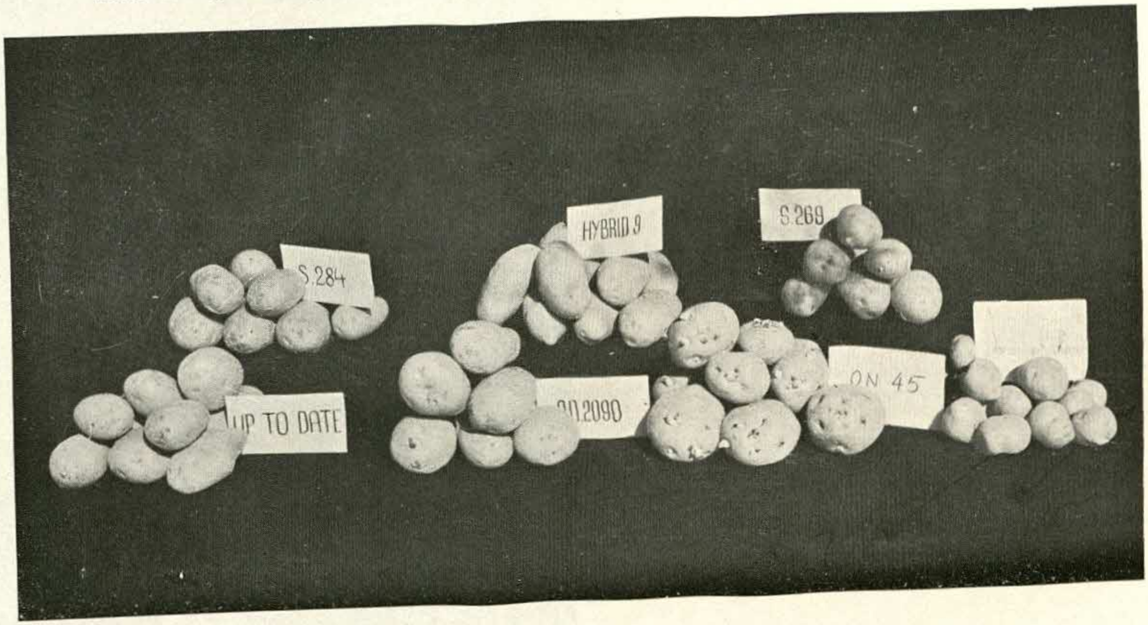
Bordeaux mixture, Perenox and also Dithane -14 have been found to be effective in checking early blight and late blight infections under conditions in the plains of India. Under hill conditions, these fungicides gave better control if sprayed during the dry spells. Dithane, however, was not very effective.

Dissemination of the leaf roll and virus Y has been found to be brought about by the aphids *Myzus persicae* and *Aphid rhamni.*

With a rapid increase in aphid population from mid-January onwards, the viruses spread rapidly often fully infecting the growing crops.

Virus and Pathological Laboratory, Central Potato Research Institute, Simla

Some new promising hybrids evolved at the Central Potato Research Institute, Simla



Plant Pathology Laboratory, Central Potato Research Station, Simla

Inoculating for virus studies, Central Potato Research Institute, Simla

Studies on pests

A survey of diseases and pests has indicated that cutworms, *Epilachana* beetle, white grubs and root-knot nematode are the most common pests of potato both in the hills and plains of India. The tuber moth is a serious pest in storage in the plains of India.

Investigations relating to the control of several pests have indicated that:

(*i*) 2 per cent DDT dusted over the soil gives effective control against white grubs,

(*ii*) *Epilachna* beetle can be successfully controlled by spraying with 1·5 per cent water dispersable DDT,

(*iii*) for controlling cutworms, 5 per cent DDT dust, by itself or in combination with pyrethrin, is effective,

(*iv*) almost a complete control of tuber moth is possible by treatment of potatoes with 5 per cent DDT at the rate of 2 oz. per maund and

(*v*) that excessive use of DDT on table potatoes is injurious to human health and, therefore, should not be used to control tuber moth of potatoes intended to be used for table purposes.

FUTURE LINES OF WORK

The re-organisation of the Institute as a result of the recommendations of the Expert Committee has already been referred to. Apart from the reorganisation of the Institute, its work is being expanded in several directions among which may be mentioned the following:

(*i*) Initiating cytogenetical aspects of work and strengthening breeding and genetical programmes

(*ii*) Extending and strengthening the work connected with virus research

(*iii*) Determination of conditions responsible for spread of virus diseases in the field particularly in the plains

(*iv*) Research on chemical and physiological aspects of the potato crop, particularly in regard to nutritive quality and the value of different varieties as raw products for industrial use

(*v*) Investigations relating to mechanical cultivation of potatoes in the plains,

(*vi*) Initiating and organisation of seed potato certification system in the country with a view to production of adequate quantities of pure disease-free stocks of different varieties and hybrids under commercial use

(*vii*) Research on tuber crops other than potatoes

(*viii*) Teaching and training work connected with development and research on potatoes.

INDIAN VETERINARY RESEARCH INSTITUTE

Izatnagar (U.P.)

THE Indian Veterinary Research Institute established in 1890 is the only central institute of its kind in the country for the scientific investigation of all problems connected with livestock improvement. The veterinary science has the distinction of being the first science for which the Government of India considered it necessary to set up a central research laboratory. A central institute for veterinary research was established in Poona in 1889, and subsequently shifted to Mukteswar in 1893. With the addition of the Izatnagar branch of the Institute in 1913, arrangements have been made to increase the number of research divisions so as to meet the modern scientific demand which requires the investigation of all subjects connected with the development of livestock. The Indian Veterinary Research Institute is the largest organisation in the country for purposes of conducting research on diseases, nutrition, artificial insemination, poultry and cognate matters.

The work of this Institute is carried on in six Divisions. One of these, viz. the Division of Pathology and Bacteriology is located at Mukteswar. The Divisions of Animal Nutrition, Animal Genetics, Parasitology, Poultry Research and Biological Products are located at Izatnagar.

The Institute also provides advanced training in certain subjects connected with veterinary science and animal husbandry to suitably qualified candidates. A total of 1844 post-graduate students attended the various courses offered by the Institute during the period 1890-1950.

DIVISION OF ANIMAL NUTRITION

The Animal Nutrition Division was started in 1936 when the administrative control of the Animal Nutrition Section of the Imperial Institute of Animal Husbandry and Dairying in Bangalore was placed under the administrative control of the Director, Indian Veterinary Research Institute. The Division is now divided into the following sub-sections: (*i*) Physiology, (*ii*) Pathology, (*iii*) Biochemistry, (*iv*) General analytical technique and (*v*) training.

The main function of the Division is to study nutrition in relation to the maintenance of health, normal growth and productive capacity of livestock in India. The Division is also entrusted with the co-ordination of all work carried out on animal nutrition by the different States and advises the Central and State authorities on all problems of animal nutrition. The Division also undertakes to train workers in different branches of animal nutrition research. A brief account of research work carried out in the Division is given below:

Nutritive value of feeding stuffs

A correct appraisal of the nutritive value of feeding stuffs is the first step before economic rations supplying all essential nutrients could be devised. Most of the common feeding stuffs have now been analysed and their actual feeding values have been determined. This work has, however, opened up new lines of work, for it has been found that the nutritive value of a fodder depends to a large extent on the soil-weather complex under which it is grown. For this reason, the nutritive value of feeds from different parts of India is being examined on a regional basis. Further, the nutritive value of forage is dependent on its stage of maturity. Thus, comprehensive investigations on the nutritive value of indigenous and exotic grasses have been undertaken with a view to finding out the correct time of harvesting these fodders in order that the maximum yield of nutrients per acre might be obtained.

Requirements of different nutrients

The next step was to find out the requirements of various nutrients by the Indian farm animals. So far, the data obtained by research workers in the West were utilised for this purpose, but investigations have shown that it is not usually applicable to our animals. The protein, calcium, phosphorus, magnesium, iron, copper, cobalt, manganese and vitamin A requirements of Indian cattle, sheep and goats have been worked out.

Newer sources of feeds

As a result of research carried out, it was found that the majority of our animals are underfed. An intensive programme of work was, therefore, initiated to find out whether unconventional feeds from substances which are at present being wasted or not fully utilised could be fed to the animals. It has been found that *kans* grass, *munj* grass, *kantiara*, *panwar* straw, *bajra* husk, coffee husk, sugarcane tops, bagomolasses, (a mixture of bagasse screenings with molasses), tapioca roots, etc. could be used as roughages in the cattle feeds, while mango-seed kernel, *jaman* seeds, *panwar* seeds, crushed tamarind seeds, crushed *babul* pod, rain-tree pods, *mahua* flower, *mahua* cake, maize grit, sunn-hemp seed, *guja* cake, fish meal and entrails can be used to supplement the rations with proteins, a class of nutrient in which our cattle are particularly deficient.

Another aspect of this work has been to investigate the nutritive value of tree leaves. A number of such leaves have been found to possess high nutritive value, so much so that they could maintain animals in good health. Examples of this kind are *sandan*, *gauj*, *mororfali*, *banj*, *pipal*, *gular*, *kachnar*, *bans*, *tut*, *bel* and *jharberi* leaves.

Conservation of feeds

Different types of silo pits as well as various methods of ensilage have been studied and a type of pit suitable for small holders has been devised. It was found that tree leaves when ensiled with legumes can furnish highly nutritive succulent feeds during periods when green feeding is scarce.

Improvement of coarse fodder

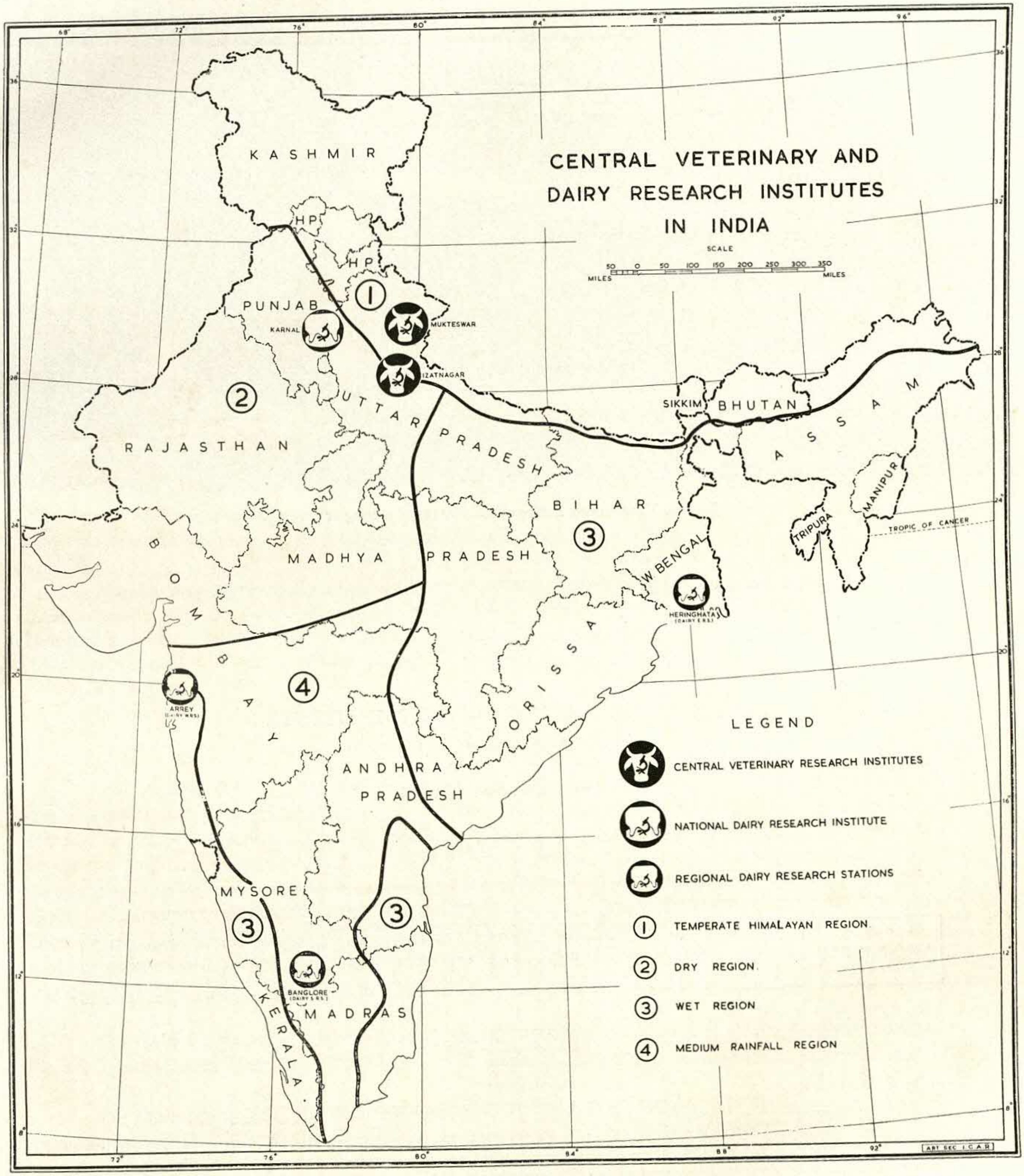
Coarse fodders like straws can be improved by treatment with dilute alkali. The processed feeds not only supply more energy to the animals consuming them, but are also found to spare substantial quantities of protein from the ration. Moreover, such treatments were found to remove deleterious substances like oxalic acid present in paddy straw. Extensive trials on the feeding of such processed straws in various farms have been undertaken, and it has been found that young calves fed on treated straws show much better growth rates.

Deficiency diseases

Nutritional surveys carried out in different parts of India have revealed pathological symptoms existing in many livestock due to deficiencies of minerals and vitamins in the ration. Thus deficiency symptoms due to subnormal intake of phosphorus, copper and vitamin A have been seen in certain areas in Madras, West Bengal, Uttar Pradesh, Punjab and Rajasthan.

On the other hand drinking water in certain localities may contain high quantities of fluorine,

[PLATE XXII


CENTRAL VETERINARY AND DAIRY RESEARCH INSTITUTES IN INDIA
SCALE
50 0 50 100 150 200 250 300 350
MILES
MILES
KASHMIR
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MUKTESWAR
IZATNAGAR
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UTTAR PRADESH
BIHAR
SIKKIM
BHUTAN
ASSAM
MANIPUR
TRIPURA
TROPIC OF CANCER
W. BENGAL
HERINGHATA (DAIRY R.S.)
MADHYA PRADESH
BOMBAY
ORISSA
ARREY (DAIRY R.S.)
ANDHRA PRADESH
MYSORE
BANGLORE (DAIRY R.S.)
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1
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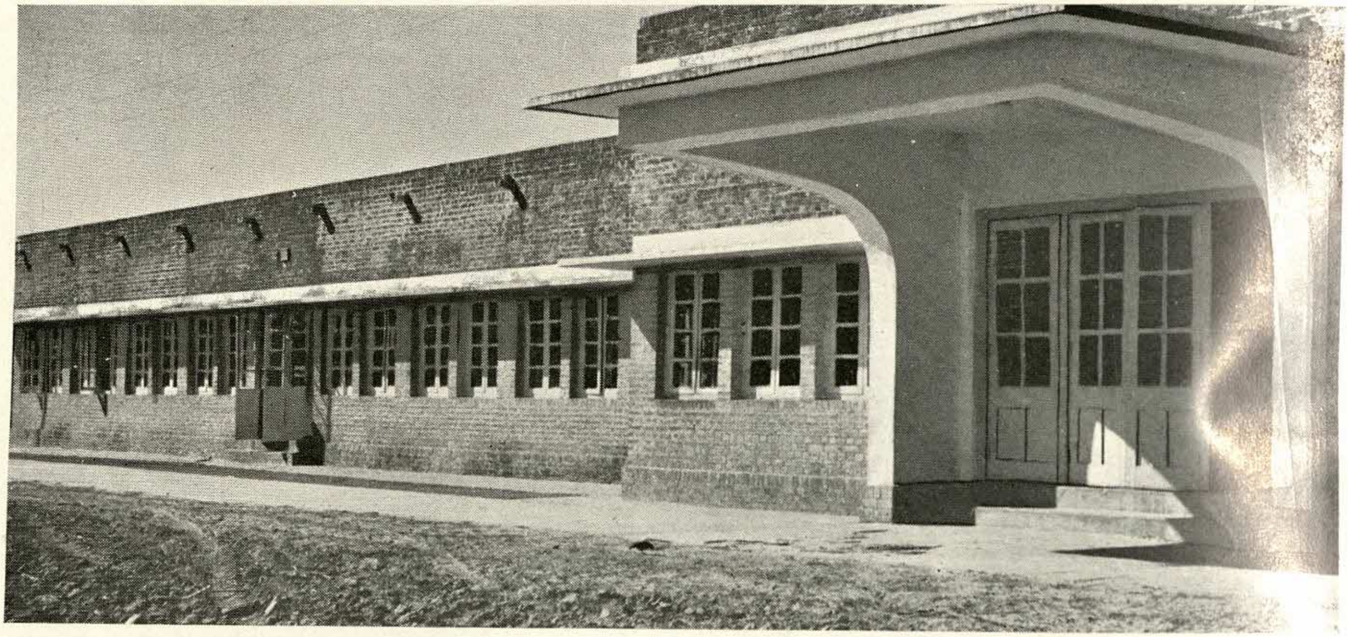
LEGEND
CENTRAL VETERINARY RESEARCH INSTITUTES
NATIONAL DAIRY RESEARCH INSTITUTE
REGIONAL DAIRY RESEARCH STATIONS
1 TEMPERATE HIMALAYAN REGION
2 DRY REGION
3 WET REGION
4 MEDIUM RAINFALL REGION
68° 72° 76° 80° 84° 88° 92° 96°
36° 32° 28° 24° 20° 16° 12° 8°
ART SEC. I.C.A.R.

PLATE XXIII]

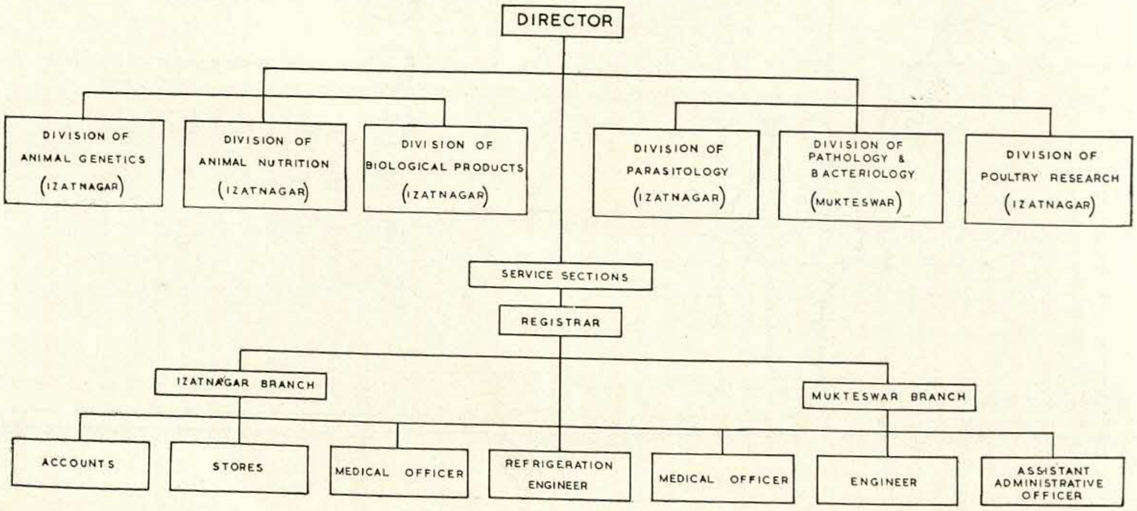


Indian Veterinary Research Institute, Izatnagar

INDIAN VETERINARY RESEARCH INSTITUTE

Izatnagar (U.P.)

Organisation Chart



DIRECTOR
DIVISION OF ANIMAL GENETICS (IZATNAGAR)
DIVISION OF ANIMAL NUTRITION (IZATNAGAR)
DIVISION OF BIOLOGICAL PRODUCTS (IZATNAGAR)
DIVISION OF PARASITOLOGY (IZATNAGAR)
DIVISION OF PATHOLOGY & BACTERIOLOGY (MUKTESWAR)
DIVISION OF POULTRY RESEARCH (IZATNAGAR)
SERVICE SECTIONS
REGISTRAR
IZATNAGAR BRANCH
MUKTESWAR BRANCH
ACCOUNTS
STORES
MEDICAL OFFICER
REFRIGERATION ENGINEER
MEDICAL OFFICER
ENGINEER
ASSISTANT ADMINISTRATIVE OFFICER

Animals in such places show various pathological symptoms like stiffness in gait, lameness and debility. Methods to combat this toxicity have been worked out.

Effect of climate

Investigations are being conducted into the physiological behaviour of different breeds and species of animals under different climatological conditions. Such findings are expected to throw more light on the problem of maintaining productivity under adverse conditions as well as selecting breeds of animals suitable for different parts of India. The relative roles of nutrition and climatic conditions are also being studied so as to elucidate the causes of degeneration of cattle in hot and humid regions.

REGIONAL SUBSTATIONS

Three substations one each at Anand (Bombay), Bangalore (Mysore) and Haringhata (West Bengal) have been started to find out the deficiencies that exist in the rations of livestock. A fourth substation for the temperate region will soon be started in the Kangra Hills. The Animal Nutrition Division at Izatnagar guides and co-ordinates the research activities of these substations.

Achievements

(i) Investigations have revealed that a number of substances which are at present being wasted could be utilised as cattle feeds, e.g. mango-seed kernel, *jaman* seed, tarmarind seed, *mahua* cake, tapioca roots, *kans*, groundnut husk, sugarcane tops, bagomolasses, etc.

(ii) An improvement of coarse fodders has been brought about by soaking of straws in dilute alkali or in water alone. The alkali treatment increases the feeding values of straws by 50-60 per cent and also removes obnoxious substances like oxalic acid from paddy straw.

(iii) Investigations on the nutritive value of *vanaspati* have revealed that when basal ration contains superadequate quantities of minerals and vitamins, there is no harm in substituting *ghee* by *vanaspati* in a diet. When, however, the diet contains subadequate or just marginal quantities of vitamins and minerals, *ghee*-fed rats are more healthy than rats fed on a similar diet but containing *vanaspati* in place of *ghee*.

DIVISION OF ANIMAL GENETICS

The Animal Genetics Division was established in 1944. It is engaged in researches on livestock genetics including problems relating to evolution of new breeds. It has undertaken systematic selective breeding of Harianas, Murrah buffaloes, Barbari goats and Bikaneri sheep for improving their productive capacity, as also to evolve a strain of poultry genetically resistant to Ranikhet disease. Investigations are also in progress on the inheritance of defective characters and blood grouping of Indian cattle with a view to determining the genetic affinities between various breeds. Research work has been carried on different aspects of artificial insemination in farm animals, pregnancy diagnosis, the problem of infertility, the standardisation of a method for draftability tests for bullocks. In addition, attention has been given to cytogenetics and other problems of fundamental genetics.

On the developmental side, the Division deals with the introduction of artificial insemination in the field, control of sterility, key village work, and supply of pedigreed Hariana bulls to different States.

On the training side, the Division conducts a three-month course in artificial insemination and physiopathology of reproduction wherein advanced training is given to veterinary officers from the

States. It also takes research students for the Associateship of the Indian Veterinary Research Institute, and post graduate degrees in genetics and allied subjects of the various Universities. In addition it takes part in the various training courses conducted by the Institute such as:

(i) Advanced Course in Animal Husbandry
(ii) Advanced Course in Poultry Husbandry
(iii) Post-graduate Refresher Course
(iv) D.T.V.Sc. Course

The Division co-ordinates the work carried out in different regional schemes sponsored by the Indian Council of Agricultural Research. It also renders advice in matters relating to scientific breeding.

A well-equipped climatological laboratory is being fitted up with a view to studying the effect of climatic factors like temperature, humidity, etc. on animal reproduction.

Achievements

(i) The successful introduction of artificial insemination on a field-scale stands out prominently amongst the notable achievements of the Institute. The planned work initiated by the Institute is chiefly responsible in making artificial insemination a practical proposition under the field conditions of India.

(ii) The investigations on the biochemistry of semen have revealed that the rate of destruction of semen sugar (fructolysis) and sperm concentration are positively correlated. Fructolysis, therefore, can be used as a guide for evaluating the sperm quality.

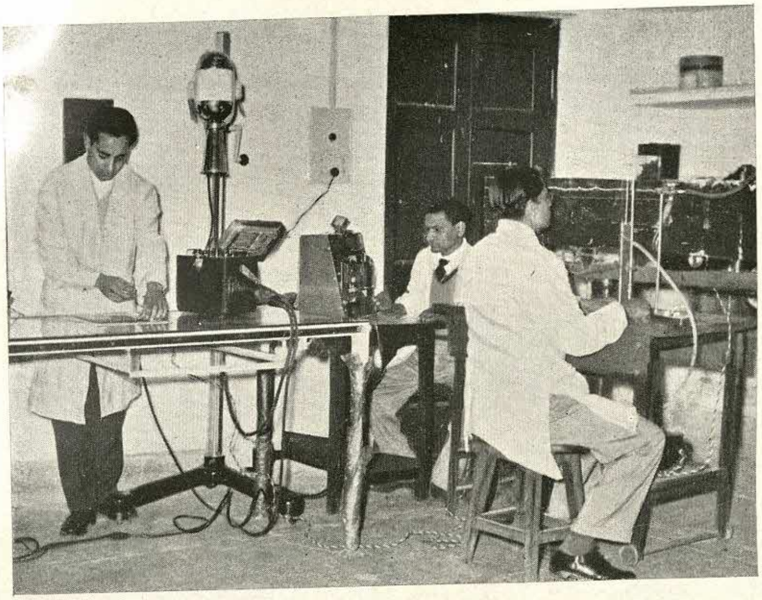
(iii) The pregnant mare serum, Gonadotrophin (P.M.S.), prepared at the Institute compares very favourably with costly commercial preparations of the hormone. Treatment with P.M.S. has been tried with success to shorten the inter-calving period of cows and she-buffaloes, and also to induce fertility in late maturing heifers.

DIVISION OF PARASITOLOGY

The main function of the Division is to study the manifold problems of parasitic infections and to devise preventive measures. In addition, the Division takes its full share of the routine activities of the Institute in the diagnosis of parasite materials from all over India and sometimes from neighbouring countries, giving expert advice on problems of parasite control, taking post-graduate classes, and imparting advanced training in research and control of parasites. The work of the Division is carried out in three sections, viz. the Sections of Helminthology, Protozoology and Entomology.

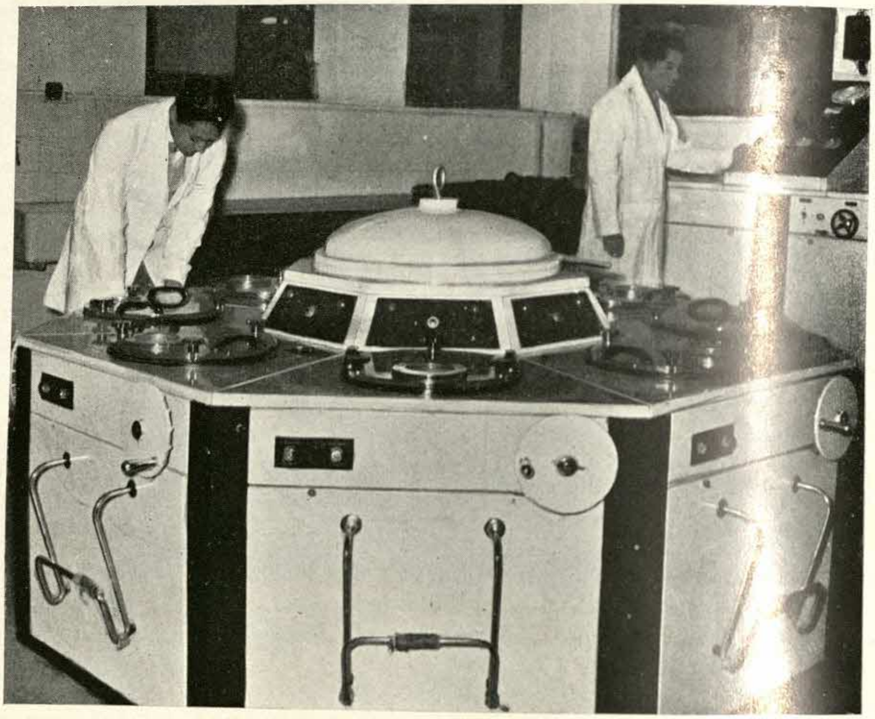
Veterinary Helminthology aims at the conservation of animal health through control of parasitic worms of livestock. A great majority of the domesticated animals in India is infected clinically or subclinically with worms. This is only natural in a tropical country with a large animal population, which offers favourable topographical and climatic conditions for the multiplication and spread of worms. The helminthological researches carried out in the Division have not been merely of a confirmatory nature but have broken entirely new grounds; a large number of new or previously unrecorded parasites of livestock have been discovered, and some diseases of unknown etiology have been proved to be of a helminthic origin. The modes of spread, pathogenecity and control of several important helminth parasites have been studied.

All species of domesticated animals are susceptible to infection with pathogenic



Physiology Laboratory, Indian Veterinary Research Institute, Izatnagar

Biochemical Laboratory, Indian Veterinary Research Institute, Izatnagar



Mammoth centrifugal freeze-drying unit for lyophilisation of virus - vaccines at Indian Veterinary Research Institute, Izatnagar

Grading and incubating eggs, Indian Veterinary Research Institute, Izatnagar

protozoa, and several important diseases of livestock are caused by protozoan parasites. Transmission of protozoan infections is brought about either through the ingestion by the host of the infective, stages of the parasites, or by an intermediate host of the infective stages of the parasites, or by an intermediate host or vector, usually a biting arthropod. Preventive treatment and control measures are based on a knowledge of three main factors, viz. biology of the protozoa, its vector and host-parasite relationship. The important protozoan diseases which have been studied are surra, coccidiosis, babesiasis and theileriasis. The recovery of an animal from a protozoan infection often does not mean complete disappearance of the parasite from the animals system. Such apparently free animals serve as carriers and are potential sources of danger to healthy animals, should the necessary vectors be present. A method has been evolved for the diagnosis of latent forms of surra parasites.

Veterinary entomology is concerned with the study of athropod pests of domestic animals and their parasites and predators, the damage caused by them to animals and animal products, the transmission of diseases through them, and the measures for the control of these pests. The biology of the warble flies affecting cattle and goats, and causing very heavy damage to the hides and skins of these animals, has been studied in detail and methods for their prevention have been developed. The arthropod vectors of some protozoan parasites have been discovered, and the role of others in the transmission of some bacterial and virus infections has been investigated. The efficacy of a number of insecticides in the control of arthropod pests of livestock has been determined.

Achievements

(i) It has been discovered that certain helminths are the causative agents of a group of obscure diseases which had baffled solution for a very long time, e.g. bursati, equine lichen tropicus, nasal granuloma and hepatic cirrhosis in equines.

(ii) In the control of warble fly, successful results have been obtained in the field by periodically singeing the hairs on the legs of cattle during its egg-laying season.

(iii) An allergic test for diagnosing latent cases of surra, a protozoan infection, has been evolved. The efficacy of commercial preparations, e.g. 'Naganol' and 'Antrypol' have been established for the treatment of surra.

(iv) A simple method of demonstrating the presence of protozoa in intact salivery glands of ticks, obviating the necessity of cutting serial sections of ticks, has been developed.

DIVISION OF POULTRY RESEARCH

The Division has been carrying on pedigree breeding and multiplication of pure bred strains of White Leghorn, Rhode Island Red, Barred Plymouth Rock, *Desi*, Australorp, New Hampshire, Black Minorca and the upgraded strains of the various breeds. The improvement of the non-descript poultry by up-grading the village hens with cocks of exotic breeds as White Leghorn and Rhodes have given successful results.

Increased production through cross-breeding

The offsprings of the matings of B.P.R. × R.I.R. ; W.L. × R.I.R., R.I.R. × W.L., and W.L. × B.P.R. as well as the back-crossing of the cross bred daughter to sire of the alternate breeds have proved superior in respect of all economic characters to those of the pure breeds.

The average egg production of the *Desi* hen to begin with was 116.1 eggs. As a result of upgrading, in favourable environments even in the first generation the beneficial influence of crossing indigenous hens with pure breeds is demonstrated by improved laying performances as detailed below:

White Leghorn first cross	160.84 eggs
Rhode Island Red	147.4 ,,
Barred Plymouth Rock	189.8 ,,

The improvement indicated above has been satisfactorily maintained, with progressive increase in the number and size, during the subsequent six or seven generations of up-grading. Experimental matings of graded males with graded females have also been made to study bad effects if any in this progeny.

Feeding

The beneficial effect of the addition of sugar factory refuse (yeast sludge) in poultry rations has been investigated. A supplement of 10 per cent sludge to a normal layer ration produced 7 per cent increase in egg production. The sludge, a waste product in fermentation industry, has, therefore, a supplementary value in poultry ration.

An antibiotic and vitamin B-12 supplement was fed under controlled conditions in trace quantities along with a standard poultry mash to an adequate number of chicks. The results indicated that the addition of the trace substance had a beneficial effect on growth and freedom from disease.

Beneficial growth results have been obtained by brooding chicks on old soiled litter, and this has been attributed to the intake by the chickens of vitamin B-12 and other growth promoting factors produced by the microflora in the droppings. This result has considerable practical value. The age-old method of setting fire to soiled bedding as a prevention against certain diseases needs scrutiny. It has been found possible to raise very healthy broods free of coccidiosis trouble by the use of built-up litter.

Technology

Among the important research work carried out are the following:

(i) The influence of breed and season on the internal quality and vitamin A content of eggs

(ii) The influence of breed, shape and size of eggs on their internal quality as well as yolk-white ratio

(iii) The effect of defertilization on the maintenance of quality of eggs when transported to long distances by rail

(iv) The keeping quality with special reference to edibility of hard boiled eggs as compared with stored fresh eggs

(v) Studies on the effect of reducing agents on the stability of the yolk and white of eggs

(vi) Canning of chicken meat and table poultry

In all these cases very interesting results have been obtained.

Diseases

A vaccine for immunising against Newcastle disease, attenuated by serial passage in eggs, has been developed and is now being supplied in freeze-dried condition for the control of 'Ranikhet' or Newcastle disease.

An egg-adapted fowl-pox vaccine has been developed for vaccinating five-week old chickens which gives life-time immunity. An egg-adapted pigeon-pox vaccine for vaccinating baby chicks is under trial, and has given very promising results under experiments.

An egg-grown vaccine for Spirochaetosis has been evolved. Immunised birds resisted experimental challenge up to two years in trial experiments.

A *Salmonella pullorum antigen* has been evolved which is very sensitive and is capable of removing 100 per cent of the reactors and is being used in the field to check the disease.

Achievements

(i) By selective breeding of village hen over ten generations, an improved *Desi* strain has been evolved whose average annual egg production is about 150, while individual hens have laid up to 234 eggs. The size of eggs has also been considerably improved.

(ii) A valuable contribution to poultry nutrition has been made by standardising a method for the determination of the digestibility coefficients and biological values of proteins in poultry rations. The method has proved very useful for the formulation of economic rations for poultry.

(iii) Investigations on the economic feeding of poultry have shown that the inclusion of waste products, such as mango-seed kernel and treated cowdung, in simplified poultry rations produce beneficial results.

(iv) In the field of technology it has been demonstrated that the colossal economic loss and spoilage of table eggs due to embryo development during summer months, can be prevented by heat treatment of the egg in water at 130°F. for 15 minutes. Further improvement in keeping quality can be effected by dipping the heat treated eggs in lime-water or oil.

(v) Salmonellosis or B.W.D., responsible for widespread losses of baby chicks in Western countries has been reported and studied here for the first time. This is being successfully controlled by blood test.

DIVISION OF BIOLOGICAL PRODUCTS

It was in the year 1890 that the beginning of the Biological Products Division was made with the establishment of the Indian Veterinary Research Institute. Researches were undertaken to evolve suitable biologicals for the prevention of epizootics which take a heavy toll and make the livestock industry hazardous. During these 66 years of its existence, this Division has made considerable progress and has established its reputation as an important biological products manufacturing unit.

From a very modest beginning with the preparation of anti-rinderpest serum at Mukteswar, this unit started manufacturing six biologicals in 1901 when the parent unit was transferred to Kargaina (six miles from Izatnagar). In 1923 the unit was finally located at Izatnagar.

The Division has been able to supply 28 different biologicals for use in combating animal epizootics not only in India but also in the neighbouring countries. The biologicals manufactured at this Unit are highly efficacious and have been appreciated by scientists for their effectiveness and high standard.

The necessity of modernisation of the production of veterinary biologicals was keenly felt. Effective steps in this direction were taken with the assistance of the U.S. Point-Four Programme and the F.A.O. with a view to producing large quantities of veterinary biologicals for use in India and for export, to improve the standard of veterinary biologicals, to produce biologicals at a more economical level, and to impart training facilities to workers in this line in order to co-ordinate a better production programme.

During the period 1951-56, the old buildings have been remodelled and a new virus vaccine manufacturing unit has been established.

The Division has also undertaken the manufacture of freeze-dried rinderpest vaccine required for use in the rinderpest eradication campaign.

Achievements

(i) The Division is manufacturing anti-rinderpest serum, anti-haemorrhagic septicaemia serum, anti-anthrax serum, anti-blackquarter serum, haemorrhagic septicaemia vaccine, blackquarter vaccine, fowl cholera serum and fowl cholera vaccine.

(ii) The Division has been able to meet the demand for various biological products in fairly large quantities from various foreign countries, e.g. Afghanistan, Iraq, Iran, Egypt, Ceylon, Siam, Malaya and China. In 1949-50, 45,86,364 doses of vaccine were issued as compared to 33,69,725 in 1937-38.

DIVISION OF PATHOLOGY AND BACTERIOLOGY

This Division is situated at Mukteswar in the foot-hills of the Himalayas in the Kumaon Division of Uttar Pradesh. The Division is intended to conduct researches on animal diseases of bacterial and virus origin with a view to evolving suitable methods for their treatment and control. It carries on general disease investigation work with a view to rendering assistance in this connection to the veterinary and animal husbandry departments of various States. It undertakes the manufacture of certain biological products which the Biological Products Division at Izatnagar may not be in a position to produce. It also undertakes testing of biological products manufactured at the Institute, both at Izatnagar and Mukteswar, as regards their safety and potency with a view to maintaining a check on their quality. The Division provides advanced post-graduate training in the subjects of pathology, bacteriology, preventive medicine, technique of manufacture of biological products, methods of general diseases investigation, etc. It renders diagnostic service to the States and also gives advice with regard to the diagnosis and control of animal disease.

Achievements

(i) *Rinderpest*: As a result of years of extensive work, suitable vaccines have been evolved for the immunisation of all types of susceptible stock. These studies have made it possible to launch a country-wide scheme for the eradication of rinderpest.

(ii) *Ranikhet disease in fowls.* The successful evolution of a vaccine against this dreadful disease has made poultry rearing a profitable proposition.

(iii) *Bacteriologic septicaemia.* An adjuvant vaccine has recently been developed against this curse of livestock which is responsible for over 30,000 deaths in cattle and buffaloes per year. The new vaccine confers reasonable immunity for quite a long period.

Besides, important researches have been carried out on several diseases, such as anthrax, black-quarter, tuberculosis, foot-and-mouth disease, surra, piroplaemosia, mastitis, brucellosis, Johne's disease, bursati, dourins, kumri, contagious caprine pleuro-pneumonia, bovine endemic haematuria, etc. and the aetiology of several hitherto obscure diseases established.

NATIONAL DAIRY RESEARCH INSTITUTE

Karnal (Punjab)

SYSTEMATIC dairy research work to solve the problems of the industry was started only recently with the establishment of the research laboratories of the Indian Dairy Research Institute, Bangalore, in 1941-42. Till then, this Institute since its inception in 1923, was mainly devoted to the work of training dairy technicians and cattle development work. Investigations on certain allied aspects like animal breeding, animal nutrition and diseases of cattle have, however, been in progress for a number of years at other institutions such as the Indian Agricultural Research Institute, the Indian Veterinary Research Institute, the Agricultural Institute at Allahabad, etc. Some fundamental work concerned with biochemistry of milk and related aspects is also carried out at the Indian Institute of Science and some of the agricultural and veterinary colleges. The Indian Council of Agricultural Research has been functioning as a central agency for co-ordinating agricultural and animal husbandry research throughout the country, and has also sponsored a number of important dairy research schemes. The Indian Dairy Research Institute at Bangalore has, however, continued to be the main centre for dairy research and training in this country.

As a result of the work done at the Indian Dairy Research Institute, Bangalore, as well as at a few other centres in the country during the last 25 years, many valuable contributions have been made in regard to the development of cattle, organisation of milk production and distribution, composition and microbiology of milk, utilisation of milk and other important aspects of dairying. A brief reference to some of the outstanding results of these studies is made below.

IMPROVEMENT OF CATTLE

In connection with the improvement of dairying in India, primary attention has naturally been given to the improvement of dairy cattle and buffaloes. With the exception of a few herds of typical milch breeds, such as Sahiwal and Sindhi cows and Murrah buffaloes, the bulk of the cattle population in the country is of very poor milk-producing capacity. For improving the milking quality of these cattle, the early experiments were concerned with cross-breeding them with imported bulls of Ayrshire, Holstein-Friesian and other foreign breeds noted for their high milk production. The first crosses gave striking increase in milk yield and this aspect has been fully exploited in many urban areas for increasing the milk supply. Continued introduction of foreign blood, however, eventually affected the constitution of the animals. These animals could not stand the rigours of tropical climate. Back crossing of these cows with Zebu bulls again reduced their milk yield. Workers at the Allahabad Agricultural Institute, Naini, have evolved a new type of Jersey X Red Sindhi animal with as little as 1/16 part of Jersey blood by forward and back crossings. It has been found that European cattle are not able to thrive under tropical conditions due to their poor heat tolerance and high nutritional requirements and the same handicaps are transferred to the cross-bred stock. Hence this method of improving Indian cattle as a general policy was discontinued, and it is now proposed to try it out in hilly and heavy rainfall areas where other methods of cattle improvement have not been found to be successful.

Another important approach made for improving the cattle of India was by developing pedigree herds of well defined breeds of cattle, e.g. Sahiwal, Red Sindhi, Gir, Tharparkar, etc. by careful breeding, feeding and management. As a result of breeding work over a number of years, the Sahiwal and Tharparkar herd at the Indian Agricultural Research Institute, the Red Sindhi and Gir herds at the

Indian Dairy Research Institute and a few other breeds have been developed to a high standard of efficiency. The average milk yield of the Sindhi and Gir herd at the Dairy Institute has been nearly doubled during the last 23 years. A large number of these bulls have been used for grading up local cattle for higher milk production. Similar experiments in developing certain typical draft breeds of cows as 'dual-purpose' animals have also been made at different farms. Some of these animals have been used for grading up local cattle in other countries such as Ceylon, Malaya, Philippines, etc. and very satisfactory results have been reported.

Experiments on the grading of local stock by artificial insemination, using semen of approved bulls on the farm, have given very encouraging results and this has opened up great possibilities of rapidly improving the milking quality of Indian animals scattered in different parts of the country.

There are several other aspects of animal husbandry research on which work is going on in the country, e.g. the problem of cattle nutrition in different regions, degeneration of cattle in hot and humid zones, detection and control of bovine diseases and so on, which have a very important bearing on the development of cattle in India.

MARKET MILK

The bulk of the milk in India is produced in villages and it has to be brought to urban centres where there is demand for it. Due to insanitary methods of production and handling, milk gets contaminated by a large number of micro-organisms coming from a variety of sources. The subsequent exposure of milk to warm atmospheric temperatures during its transport and distribution favours the rapid multiplication of these bacteria which bring about the spoilage of milk by their activities. Several problems concerned with the production of clean milk under village conditions as well as on organised farms and the collection, processing, transport and distribution of milk under various conditions have been studied. The numbers and types of bacteria commonly found in market milk have been determined and this information will be of use in formulating standards of bacteriological quality for grading milk supplies. An evaluation of the different conditions of production has revealed that improperly cleaned utensils constitute the most serious source of infection in milk. If the milk utensils are thoroughly washed and finally rinsed in boiling water or in a weak solution of bleaching powder, the bacterial contamination is greatly reduced with a consequent improvement in the keeping quality of milk. A comparative study of the sanitising efficiency of a number of indigenous and imported detergents in the cleaning of dairy utensils is in progress with a view to evolving a cheap and efficient cleaning mixture which can be used both for cleaning as well as sanitising dairy utensils.

It is well known that in Western countries milk is generally pasteurised, which ensures the destruction of all disease-producing germs and a majority of other bacteria present in it. The pasteurised milk is then cooled and held at a low temperature during its transport and distribution, to prevent any further bacterial growth. An investigation is in progress at the Dairy Institute to study the effect of different time-temperature combinations of pasteurisation treatment on the destruction of bacteria commonly encountered in Indian milks with a view to standardise the process for use in this country. Alternative methods of processing milk to improve its keeping quality have also been examined. One of the methods tried consists in chilling the milk at the time of collection, and transporting it in insulated containers. Another method, which has given satisfactory results, involves intermittent heat-treatment of milk. Milk is initially heated to 170°F. for 10 minutes or just boiling to destroy the vegetative forms of all bacteria and then subjected to a second heat-treatment after an interval of 8 to 10 hours to allow the heat-resistant spores of bacteria to germinate into vegetative cells which are more easily killed. Based on this principle an outfit fitted into a van for the collection and processing of milk has been designed and used successfully for transporting milk over long distances. Another process, involving the

A modern milking byre at the Regional Dairy Research Institute, Bangalore

Students learning to make butter at the Regional Dairy Research Institute, Bangalore

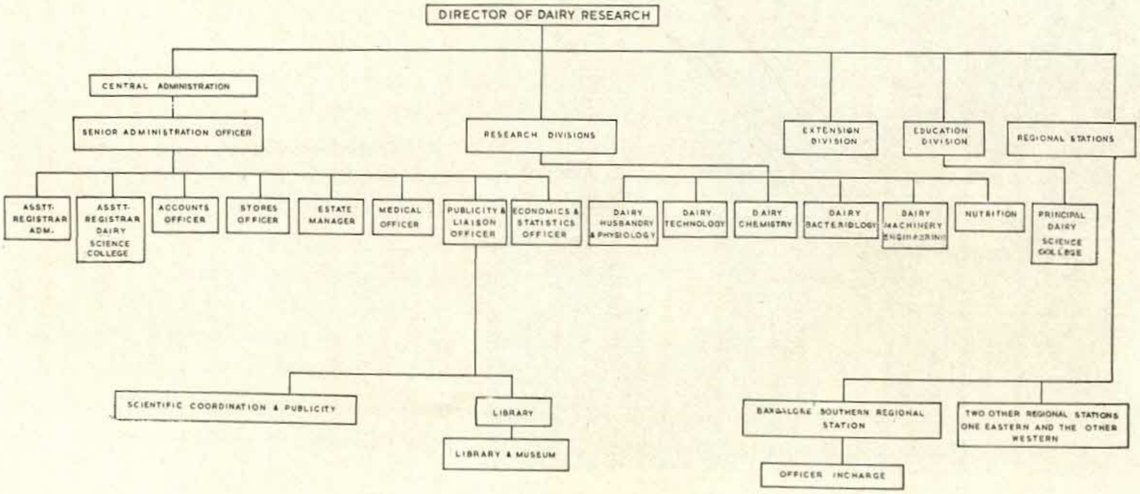
PLATE XXVII]

Feeding a weaned calf at the Regional Dairy Research Institute, Bangalore

NATIONAL DAIRY RESEARCH INSTITUTE

Karnal (Punjab)

Organisation Chart


DIRECTOR OF DAIRY RESEARCH
CENTRAL ADMINISTRATION
SENIOR ADMINISTRATION OFFICER
RESEARCH DIVISIONS
EXTENSION DIVISION
EDUCATION DIVISION
REGIONAL STATIONS
ASSTT. REGISTRAR ADM.
ASSTT. REGISTRAR DAIRY SCIENCE COLLEGE
ACCOUNTS OFFICER
STORES OFFICER
ESTATE MANAGER
MEDICAL OFFICER
PUBLICITY & LIAISON OFFICER
ECONOMICS & STATISTICS OFFICER
DAIRY HUSBANDRY & PHYSIOLOGY
DAIRY TECHNOLOGY
DAIRY CHEMISTRY
DAIRY BACTERIOLOGY
DAIRY MACHINERY ENGINEERING
NUTRITION
PRINCIPAL DAIRY SCIENCE COLLEGE
SCIENTIFIC COORDINATION & PUBLICITY
LIBRARY
LIBRARY & MUSEUM
BANGALORE SOUTHERN REGIONAL STATION
OFFICER INCHARGE
TWO OTHER REGIONAL STATIONS ONE EASTERN AND THE OTHER WESTERN

addition of edible grade hydrogen peroxide in suitable concentrations to milk followed by pasteurisation, has been found to be very satisfactory for preserving milk at atmospheric temperatures up to 24-36 hours.

The differences in the chemical composition of milk and butter-fat of cow, buffalo, goat and sheep and variations due to breed, stage of lactation, season, feed and other factors have formed the subject matter of extensive investigations. These studies have provided valuable data for fixing legal standards of chemical quality for milk and *ghee*. Detailed studies have also been made on the nitrogenous constituents, minerals, vitamins and minor constituents of milk, phosphatase and lipase activities, and the influence of souring, heat-processing and other factors on the compositon of milk. Series of studies have been made to evaluate the nutritive value of milk and milk products in relation to the Indian dietary.

Comparative studies on the application of various chemical and bacteriological tests for the analysis and quality control of milk under Indian conditions have been made and the methods standardised. Based on the variations in freezing point of milk, a reliable method of detecting added water in milk has been standardised. A new test using triphenyl tetrazolium bromide for detecting poor quality milk supplies has been developed in which milk samples containing a large number of bacteria show the rapid development of a deep red colour upon the addition of the indicator.

MILK PRODUCTS

Although the amount of milk available for human consumption is very low, over 60 per cent of the total amount of milk produced in the country is used for conversion into various products mainly due to difficulties in the way of marketing of fluid milk. Of these products, *ghee* is the most important as it accounts for nearly 45 per cent of milk production. Due to defective methods of preparation and storage, the flavour and keeping quality of market *ghee* are very poor and a number of investigations have been carried out at the Dairy Institute to elucidate the causes for the poor quality of the product, and to standardise the conditions of its manufacture and storage. It has been found that the early development of rancidity and loss of flavour and of vitamin A in *ghee* is greatly influenced by the quality of butter from which it is made. If the butter is highly acidic and has developed rancidity due to hydrolysis of fat by microbial action, the quality of *ghee* will be poor. Emphasis has, therefore, been laid on the use of boiled milk for making *dahi*, and early churning of the curd and conversion of butter into *ghee*. By treatment with 3 per cent lime, the high acidity of market *ghee* can be neutralised. An improved method of *ghee* manufacture by pre-stratification of butter has been devised which enables the mechanical removal of a large portion of water from butter prior to its clarification at 115°C. A *ghee* clarifying plant embodying the above principles has been designed and it has given satisfactory results in field-scale trials. Considerable amount of work has been done to develop suitable tests for the detection of adulteration of *ghee* with hydrogenated oil and other fats. Compulsory addition of sesame oil to *vanaspati* and colourisation of *vanaspati* wih a fat-soluble colour are two of the methods suggested.

Dahi or curd is another important milk product in this country since it is consumed as a food adjunct and as a beverage and also forms an intermediary in the manufacture of butter and *ghee*. The Dairy Institute has carried out a comprehensive investigation into the quality of *dahi* produced in different parts of the country and the nature of the organisms associated with the different qualities of *dahi*. The conditions for the production of good quality *dahi* have been standardised and starter cultures containing suitable combinations of lactic acid bacteria have been prepared for use in the preparation of *dahi*, fermented butter-milk, butter, and cheese. A process has also been developed for the preparation of 'dried' starter cultures, which can be preserved at room temperatures for long periods.

Experiments are in progress to prepare these powdered cultures in the form of tablets for easy distribution. In the course of these investigations, the nutritional requirements and other characteristics of lactic acid organisms isolated from *dahi* have been studied in detail. Some of the organisms have been found to be very useful as test organisms for the microbiological assay of certain vitamins and amino acids in dairy products while a few others have shown remarkable ability to synthesise riboflavin and folic acid during the conversion of milk into *dahi*. One culture has been used for the production of flavour compounds.

The other important investigations conducted at the Dairy Research Institute are concerned with the preparation of vegetable rennet from the berries of *Withania coagulans* for use in cheese manufacture, standardisation of the methods of manufacture and storage of *khoa*, *chhana*, and casein, and economic utilisation of skim milk, whey, *ghee* residue and other by-products of milk for manufacture of edible food products. The results of these studies have a very important practical bearing on the economics of the dairy industry and on the efforts to raise the nutritional standard of the people.

Dairy Education

The Bangalore Dairy Institute has been running three regular courses of dairy training, viz. (*i*) the Indian Dairy Diploma, (*ii*) Short Course in Dairying, and (*iii*) training of honorary research workers in research methods in dairy science. The Diploma course is for a period of two years from July each year and is intended for young students of the Matriculation standard who are likely to join industrial dairy concerns as technicians or start their own dairy farms. The candidates are trained in the routine management of milch cattle, production and handling of milk, pasteurisation and bottling of milk, manufacture of milk products, cultivation of fodder crops and quality control of milk and milk products. They have also to undertake instructional tours to important cattle breeding centres, dairy farms and other allied organisations in the country. The Short Course in Dairying is intended for men who are already in the trade or are engaged in dairy farming and lasts for three to six months. The students are given practical training in general dairy-farm work and are also required to obtain intensive training in any of the fields of dairy science. The Honorary Research Workers' course is intended for candidates possessing either B.Sc., or M.Sc. degree, who are given opportunities to carry out post-graduate research work for obtaining higher research degrees.

Expansion of Facilities for Dairy Research and Education in India

The need for expanding the activities of the Dairy Research Institute, which had been functioning at Bangalore for many years since 1923, was engaging the attention of the Government of India for the past 18 years. In 1937, the then Government of India invited Dr. N.C. Wright, Director of Hannah Dairy Research Institute, Ayr, Scotland, to study conditions in India relating to the development of cattle and dairy industry. One of his important recommendations was the establishment of a well-equipped Dairy Research Institute at a central place situated in an intensive dairy tract. This recommendation was accepted and it was decided to transfer the Bangalore Institute to a place more representative of the conditions of dairying in the plains and to convert it into a first class dairy research institute. As a consequence, the late Dr. W.L. Davies of the National Institute for Research in Dairying, Reading (U.K.) , was appointed as India's first Director of Dairy Research in 1939. After careful consideration, he recommended the location of the new institute near Delhi. This recommendation was accepted. Two research sections of Dairy Chemistry and Dairy Bacteriology were opened in Delhi and were temporarily housed in the Indian Agricultural Research Institute, New Delhi. Unfortunately, Dr. Davies died in May 1941 and the further implementation of the scheme had to be postponed due to the conditions created by World War II. The office of the Director of Dairy Research and the two research sections were transferred to Bangalore and merged with the existing Institute there to form the Indian Dairy Research Institute.

On the termination of the war, the Director of Dairy Research submitted fresh proposals for the establishment of the expanded Institute at a central place and these were accepted in principle. In order to meet immediate postwar requirements some additional staff was sanctioned at Bangalore and a new section of Dairy Technology was also added. Early in 1946, the Government invited Prof. H. D. Kay, Director, National Institute for Research in Dairying, Reading (U.K.), to review the position and make suitable recommendations in consultation with the Director of Dairy Research. Prof. Kay recommended early establishment of a National Dairy Research Institute at Delhi, including the establishment of a Dairy Science College as part of the Institute, and the continuance of the Bangalore Institute as a substation.

NATIONAL DAIRY RESEARCH INSTITUTE, KARNAL

Theproposals relating to the establishment of a National Dairy Research Institute on the lines recommended by Prof. Kay were revived in connection with the Second Five-Year Plan. Under this plan it is proposed to reorganise the procurement and distribution of milk in a number of large towns throughout the country and also to establish milk product factories to absorb surpluses in certain milk pockets of the country. This intensive programme of dairy development will require a large number of dairy technicians trained in various fields of dairying. It will also be necessary to back up the developmental activity with adequate research on various problems which may arise in connection with the large-scale production, handling and distribution of milk as well as the manufacture of milk products under Indian conditions. As the existing facilities at the Indian Dairy Research Institute, Bangalore, were far too inadequate to meet the demands, both in respect of research work as well as of training facilities, the Government of India decided to establish the National Dairy Research Institute, at Karnal, where they had a farm with an extensive area of over 2,000 acres of good cultivable land lying in the heart of the main dairying tract of the country. This farm had also been maintaining pedigree herds of Tharparkar, Sahiwal and Red Sindhi cattle. The office of the Director of Dairy Research was located at Karnal in July, 1955 and the existing farm was amalgamated with it. A number of senior scientific personnel were also transferred to Karnal to look after the construction and organisation of the new Institute. A Quality Control Laboratory was also set up on the farm. The Planning Commission has accepted the proposal regarding the establishment of the National Dairy Research Institute at a cost of Rs. 160 lakhs. This expenditure has been roughly allocated as follows : Construction of buildings, paddocks for cattle, roads, residential quarters, etc.—Rs. 102 lakhs; plant, machinery and equipment—Rs. 25 lakhs, and recurring charges for salaries of staff, and miscellaneous expenditure during the period 1956-61—Rs. 32 lakhs.

Organisational set up of the N.D.R.I.

The new National Dairy Research Institute will consist of the main Institute at Karnal comprising the Research Divisions, the Administrative Organisation and the Education Wing with a Dairy Science College and three Regional Centres, the existing one at Bangalore functioning as the Southern Regional Station. It is proposed to have seven Research Divisions, namely, Dairy Husbandry, Bacteriology, Chemistry, Technology, Nutrition, Machinery and Engineering and Extension Divisions. There will be an Education Wing of the Institute with an attached Dairy Science College, a Section of Economics and Statistics, a library and a museum. The National Dairy Research Institute with its regional stations will be under the control of the Director of Dairy Research, who will be assisted by the different Heads of Divisions.

Functions of the Institute

The main functions of the National Dairy Research Institute when it is fully developed would be :

(*i*) To carry out basic research on problems in dairy industry of all-India importance. This will be effected through the activities of the Research Divisions of Chemistry, Bacteriology, Technology, Dairy machinery and Engineering, Nutrition (milk and milk products) and Dairy husbandry (including research in breeding and feeding of dairy cattle).

(*ii*) To carry out researches into similar problems but of a specific character peculiar to certain regions at its regional stations.

(*iii*) To supervise, control and co-ordinate the activities of the regional stations.

(*iv*) To disseminate the results of researches to persons engaged in the dairy industry from production of milk to its final stage of disposal to the consumer through the Extension Division.

(*v*) To impart education in all aspects of dairying from the diploma to the post-graduate stage through the Education Wing and Dairy Science College.

(*vi*) To assist in the establishment of standards of milk and milk products.

(*vii*) To advise the dairy industry and organisations and Government Departments concerned wih dairy development in the country.

Farm of the Institute

The Institute Farm, which comprises a total area of about 1,000 acres of cultivable land provided with irrigation facilities from the Jumna canal, will continue to be utilised as at present for growing the fodder required for feeding the milch herd as well as any other crops that may be needed for research purposes. Some 400 acres of the land are proposed to be set apart for study of rotational grazing and of pasture crops, which will be carried out under a programme of 'grassland research.'

The Institute herd consisting of 1,000 animals will comprise chiefly pure-bred animals of the Sahiwal, Sindhi and Tharparkar breeds of cows and Murrah breed of buffaloes. The farm-bred male stock of these scarce breeds (whose homeland is in Pakistan) will be available for distribution to the different States of India for developing their local breeds. About 4,000 pounds of milk may be produced in the farm; this will be sold to the public at Karnal or Delhi.

EDUCATIONAL ACTIVITIES

The Education Wing of the Institute with the attached Dairy Science College will impart the following types of training :—

Indian Dairy Diploma Course (2 years). An intensive course of dairy training at under-graduate level.

Graduate course; *B. Sc. in Dairying* (3½ *years*). Open to candidates who have passed Intermediate examination with science subjects.

Post-graduate training (2 *years*). Graduates in dairy science, agriculture, veterinary and other appropriate branches of science will be admitted to this course and will be awarded the Associateship of the Institute which is equivalent to M.Sc. degree.

Refresher courses. These will be given in specialised fields such as plant operation, quality control, etc. from time to time for the benefit of persons working in the line.

Short courses. These are intended to provide practical training in any particular field of dairying for persons in the trade and industry.

The Dairy Science College will have an Educational Officer and all the ancillary staff needed to make it a full-fledged teaching institution for theoretical and practical training in dairy science. The staff of the Research Divisions will also help in teaching work in specialised fields. The Education Wing of the Institute will also co-ordinate the training activities in respect of post-graduate training in different Research Divisions and the training and educational activities of the Regional Stations.

RESEARCH WORK

Each of the Research Divisions will be chiefly entrusted with the task of carrying out research work on every aspect of the problems facing the dairy industry in India and also to keep in touch with the trends and developments in different fields in foreign countries.

The Dairy husbandry Division will investigate problems pertaining to the feeding and management of dairy cows, rearing of calves, large-scale production of different fodders and their relative efficiency and economics for milk production, conservation of fodder by silage-making and drying; study breeding problems; carry out physiological studies pertaining to the utilisation of feeds in relation to milk production, growth and health, etc. Considerable emphasis will be laid on increasing milk production in our cows by research in breeding and feeding practices.

The Bacteriology Division will study problems pertaining to clean and hygienic milk production under village conditions, problems arising out of the handling and processing of milk under commercial conditions ; examine the efficiency of the different methods of processing milk such as pasteurisation, sterilisation, etc., standardise tests for the rapid determination of the quality of milk for quality control work and carry out research on problems relating to the manufacture and keeping quality of milk products.

The Chemistry Division will study the problems arising out of the variations in composition of different breeds of animals; evolve methods for detection and control of adulteration of milk and milk products ; standardise tests for the analysis of milk and milk products; and also investigate the chemical aspects of milk and milk products.

The Technology Division will chiefly be concerned with the investigations on the large-scale handling, transport and processing of milk under commercial conditions and will also run an experimental dairy for the purpose. It will also be interested in the manufacture and packaging of various milk products such as *ghee*, butter, ice-cream, indigenous milk products, condensed milk, milk powder, etc. and study the utilisation of various dairy by-products.

The Dairy machinery and Engineering Division, besides providing help in the maintenance of the equipment and machinery located in the different Divisions of the Institute, will also run the services such as supplying gas, water, steam, electric power, etc. to the Institute. This Division will also carry out research work, in collaboration with the Technology Division, on the designing and fabrication of different equipment to suit the requirements of our dairy industry.

The Nutrition Division will chiefly be concerned with evaluation of the nutritive quality of milk and milk products with particular reference to the dietary habits of our people and the different indigenous milk products manufactured and consumed in the country.

EXTENSION AND OTHER ACTIVITIES

The Dairy Extension Division of the Institute will be concerned with the examination of various problems of the industry which need investigation at the Institute and will transmit the results of research work carried out at the Institute, as well as in other parts of the world to the Industry. This Division will maintain liaison with State dairy organisations and study methods for the demonstration of the results of research work to the trade and industry for application in the field. It will also carry out investigations on new methods of extension technique and tests for evaluating the success of extension work.

The Economics and Statistics Section of the Administrative Organisation will co-operate with the Extension Division for conducting economic surveys on the conditions of dairying in different parts of the country. It will assist the Research Divisions in the statistical planning of research and evaluation of results.

SOUTHERN REGIONAL STATION, BANGALORE

With the establishment of the National Dairy Research Institute at Karnal, the Indian Dairy Research Institute at Bangalore, which has been functioning as the national centre for dairy research and education in a small way for the past 25 to 30 years, will continue to operate as the Southern Regional Station of the Central Institute. The Bangalore Institute will devote itself chiefly to research work on cross-breeding of cattle and problems having a special bearing on dairy development in South India. It will also continue as a centre for artificial insemination work in connection with the Key Village Scheme of cattle development and function as a Central Seed-Bull Depot for the collection and distribution of semen from Jersey bulls maintained on the farm and other approved sires for improvement of cattle by artificial insemination in other parts of the country. The training of students for the Short Course and Indian Dairy Diploma will also continue at the Station. The Southern Regional Animal Nutrition Centre of the Indian Council of Agricultural Research will continue to be located at this Station for dealing with problems of animal nutrition peculiar to South India.

In addition to the Southern Regional Station, it is proposed to establish two more regional stations to represent the eastern and western parts of the country, in due course. The Central Institute at Karnal will function as the Northern Regional Station for the present and give attention to dairy problems of special regional importance apart from co-ordinating the activities of all the regional stations.

CENTRAL INLAND FISHERIES RESEARCH STATION

Barrackpore (West Bengal)

THE Central Inland Fisheries Research Station was established with temporary headquarters at Calcutta in the year 1947, for the purpose of conducting scientific investigations for a proper appraisal of the inland fisheries resources of India and to evolve suitable methods directed towards their proper conservation, management and development. Permanent laboratory, hostel and residential buildings of the Station are under construction at Barrackpore, 15 miles north of Calcutta and the Research Station will shift there. The Station has at present two substations, one at Cuttack (Orissa) dealing with studies on pond culture of fresh water fishes and another at Allahabad (U.P.) for studying the riverine and lacustrine fisheries. A number of Research Units have been established recently in the station, including one located at Balugaon (Orissa) to conduct studies on the fisheries of the Chilka lake. The Station works under the direction of the Chief Research Officer and the different Sections and Units are in charge of senior officers with wide experience in inland fisheries research. There are 108 technical officers of different categories at the Station. The Institution maintains a fairly good library of books and periodicals. A 40 ft. diesel engined motor launch with facilities for laboratory and field work is stationed at Calcutta for investigations in the estuarine areas. A 22 ft. dan boat has been recently obtained for field work in the River Ganga. A 54 ft. estuarine research vessel with facilities for research and fishing is expected to be obtained very soon. The annual recurring budget of the Research Station at present (1956-57) is about 5.98 lakhs. A sum of Rs. 20.91 lakhs has been allotted under the Second Five-Year Plan for expanding the activities of the Station.

The scientific work of the Institution is broadly divided into four main divisions, Pond Culture, Riverine and Lacustrine, Estuarine and Fisheries Training.

POND CULTURE SECTION, CUTTACK

The work of the Pond Culture Section is concentrated at present in Orissa. Experiments in the culture of Indian Major Carps and Tilapia are conducted at the Experimental Fish Farm of the Station at Cuttack and in a number of selected fish farms in different parts of Orissa. On the basis of the experimental work conducted so far, it has been possible to evolve and standardise suitable techniques for the successful rearing of carp fry to fingerling stage, reducing the percentage of mortality to a very low level. This has helped in increasing the production of fish seed for cultural operations. Experiments are now being conducted with a view to standardising methods of culturing carp fingerlings to a marketable size. Investigations on the efficiency and economics of different types of manures for increasing the productivity of fish ponds, the role of soil in pond productivity, various methods of controlling rank growth of vegetation in different types of waters, etc. are in progress. The Major Carps of India do not breed in ordinary fish ponds and carp seed has to be collected from the natural breeding grounds of these fish in rivers, involving considerable expenditure and a high rate of mortality during transport. Experiments are now being conducted in inducing them to breed in confined waters by the application of pituitary extracts. Studies on the desirability of introducing the exotic fish, *Tilapia mossambica* in the carp culture areas of India and the possibility of utilising paddy fields for the culture of fish are two other important items of work being conducted at Cuttack. The Pond Culture Section has also been providing technical assistance to some of the State Fisheries Departments by helping them to locate and collect the fish seed and demonstrating improved cultural techniques.

Riverine and Lacustrine Section, Allahabad

The Riverine and Lacustrine Section which is stationed at Allahabad is mainly engaged in investigations on the fish and fisheries of the Ganga River. The biology of a number of riverine fishes of economic importance, has been studied in detail. An intensive programme of survey to assess the fisheries of the river has been initiated recently. The Section has also been engaged in locating the breeding grounds of carps in various river systems and assisting State Governments in exploiting them. Studies were undertaken to standardise an economical method of transporting carp seed in oxygen-filled containers. Surveys in connection with the construction of multi-purpose river valley projects, with the purpose of formulating suitable measures of fishery development in the reservoirs and river basins have been a regular programme of work of the Section. A new Research Unit has been established with temporary headquarters at Calcutta to evolve suitable methods of developing and managing the lake and reservoir fisheries. The establishment of numerous industrial installations along the rivers has given rise to the problem of river pollution on account of the discharge of industrial effluents and domestic sewage, which seriously affect the fishery resources of these waters. The Section has been investigating the extent of damage caused to fisheries by pollution in selected areas and recommending remedial measures. In view of the rapid industrialisation of the country, and the necessity of investigations of water pollution on a large-scale, a separate Unit has been established for the purpose.

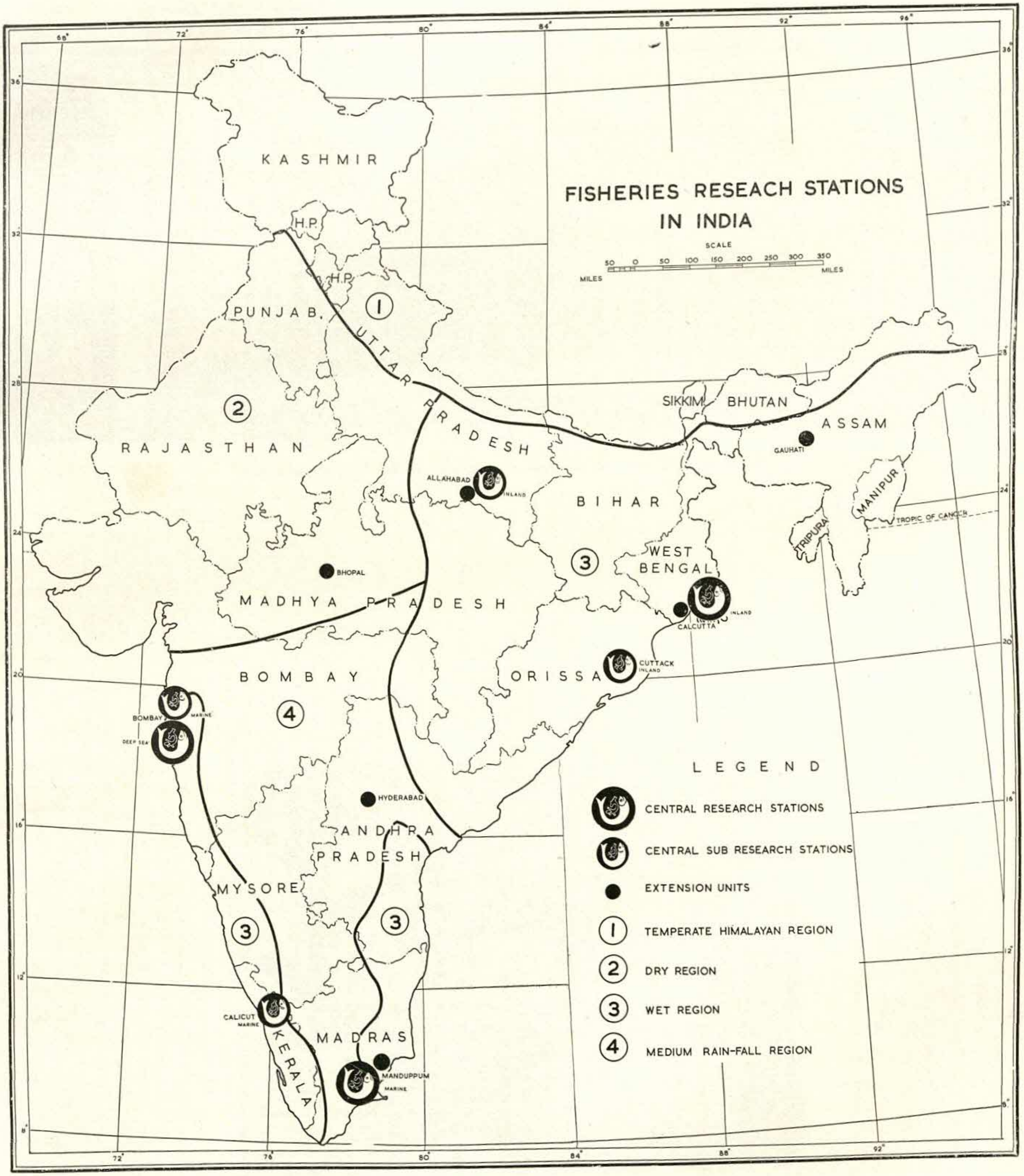
Estuarine Section, Calcutta

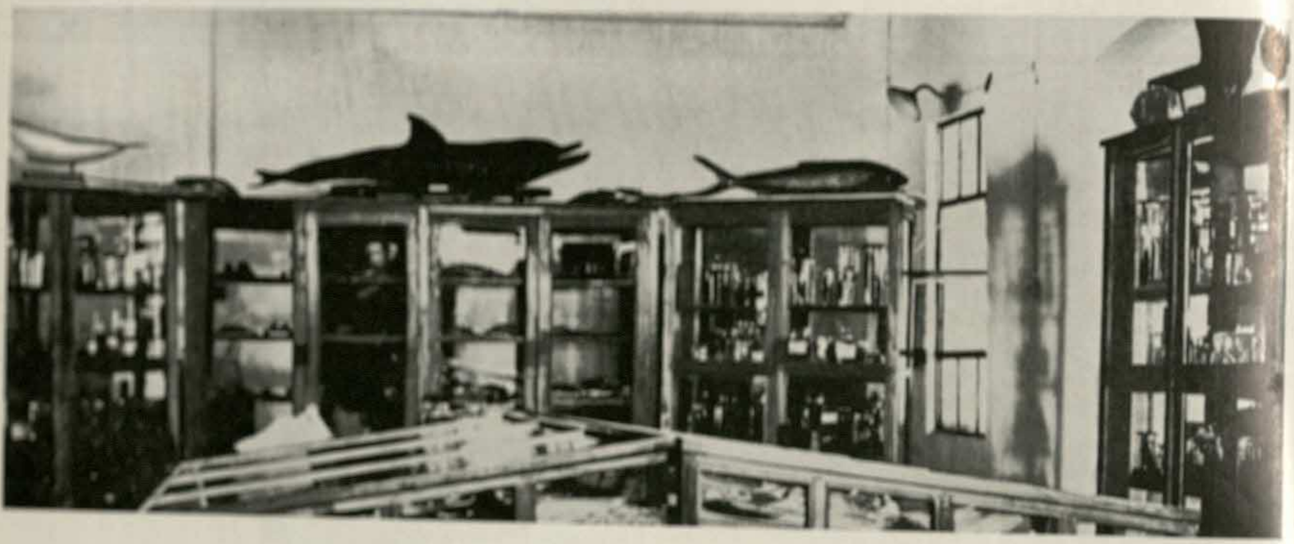
The Estuarine Section of the Institution undertakes investigations on the capture and culture fisheries of brackish water areas. The Section is located at present at Calcutta. Basic studies on the biology of a number of important groups of estuarine fishes such as the Hilsa, Mullets, Threadfins, and Prawns have been conducted. A sampling survey to collect statistics of fish catches from the dispersed estuarine areas of West Bengal was initiated by the Section for the first time, and the reliability of the technique employed is being tested by a Statistical Unit which has been recently established to design suitable methods for the collection of catch statistics from inland waters. A number of survey centres have been established in different parts of the estuarine areas. A programme of investigations to assess the magnitude of fish populations of the Hooghly and Matlah estuaries in West Bengal and the Mahanadi estuary in Orissa, as also the factors affecting the fluctuations of the fisheries in them, including hydrobiological features, is now in operation. Hilsa affords a fishery of very great importance in India, Pakistan and Burma. On account of its importance and the marked fluctuations observed in its catches from year to year, Hilsa fisheries of the region have formed a subject of special interest to the Indo-Pacific Fisheries Council. On the recommendation of the Council a National Hilsa Research Unit has been established in the Section to conduct detailed investigations on the Hilsa fisheries of India in co-operation with the Governments of Pakistan and Burma. Considerable progress has been achieved in recent years in studies of the population structure and life history of the fish.

There is a vast scope for the development of brackish-water fish culture on a commercial scale in the estuarine and coastal areas of the country. Indigenous practices of culturing fishes like Mullets, Bhetki and Prawns also exist at present in certain States. With a view to developing scientific methods of culturing these fishes, observational and experimental studies have been undertaken in the Section. The role of soil in the productivity of brackish-water ponds and the factors governing the growth and multiplication of algae which form the food of many of the cultivated fishes are being studied now. An experimental brackish-water fish farm will be established soon in West Bengal to conduct large-scale experimental studies.

A separate research unit to investigate the fisheries of the brackish water of Chilka Lake (Orissa), which are believed to be getting depleted, has been established recently under the Second Five-Year Plan.

[PLATE XXVIII





Museum, Central Marine Fisheries Research Station, Mandapam

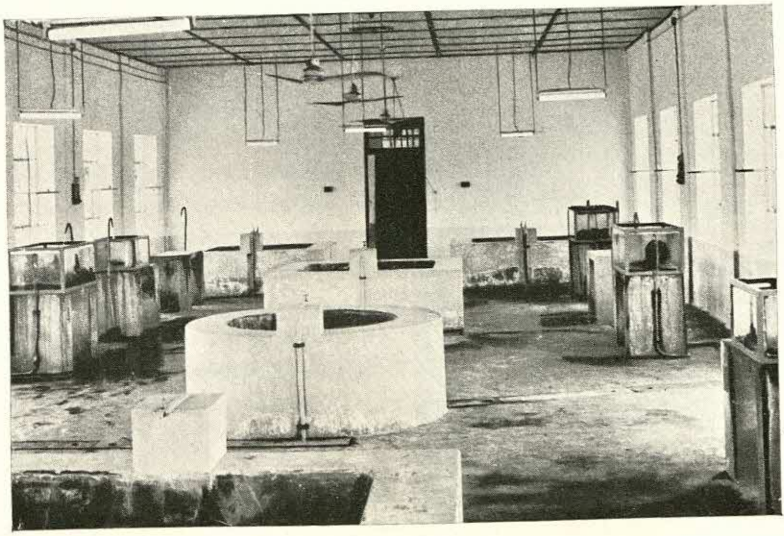
Algology Section, Central Marine Fisheries Research Station, Mandapam

TRAINING SECTION, CALCUTTA

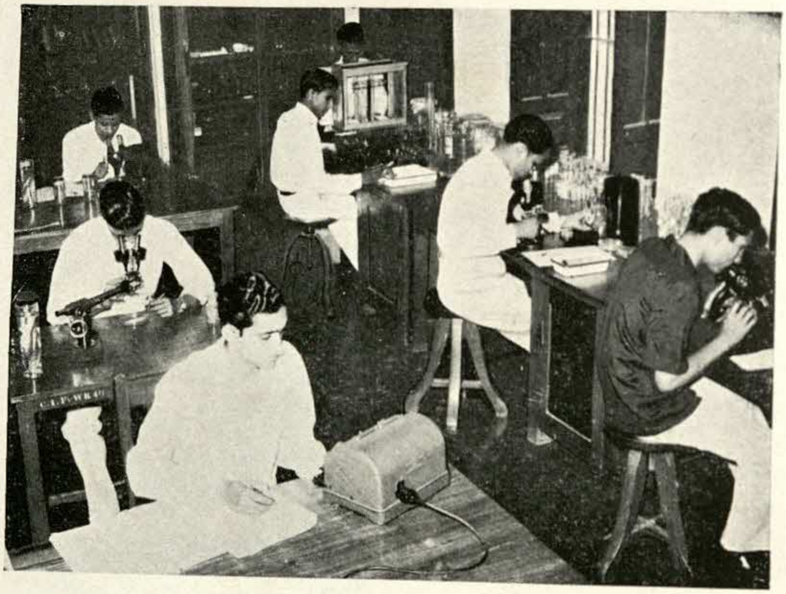
Ever since the establishment of the Station, the training of candidates deputed by various States and other organisations in inland fishery science and administration has been an integral part of its activities. The candidates who are generally biology graduates are given a ten month's course of instruction including extensive practical and field work. Besides these, a number of officers deputed by State Governments and by certain Asian countries have been given specialised short-term training at the Station.

The non-availability of good quality fish seed was a great handicap in the way of extending fish culture in many States of India. The Station, therefore, started a programme of carp seed supplies to deficit States in year 1950. The supplies were arranged through a Fish Seed Syndicate sponsored by the Station. At present this work is handled by the Fisheries Extension Unit of the Ministry which was till recently attached to the Station.

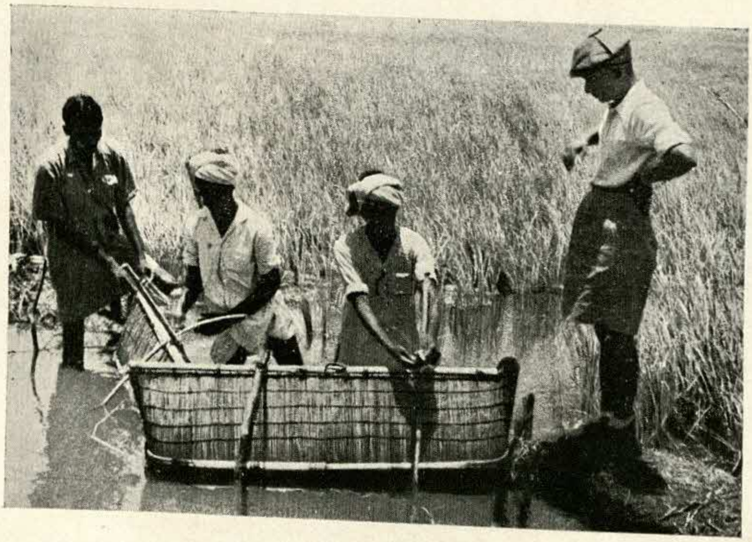
Packing fish seed for transport



Central Marine Fisheries Research Station, Mandapam



Laboratory, Riverine Substation, Allahabad



Collecting major carp fingerlings in traps from rice fields in Andhra Pradesh

CENTRAL MARINE FISHERIES RESEARCH STATION

Mandapam Camp (Madras)

THE Central Marine Fisheries Research Station at Mandapam Camp is an all-India Research Institute under the Government of India, Ministry of Agriculture and handles researches pertaining to marine fisheries. The work of the Institute is broadly divided into the following categories: (a) Fishery Survey, (b) Fishery Biology, (c) Physiology and other aspects, and (d) Marine Biology.

FISHERY SURVEY

Fishery Survey aims at assessing the marine fishery resources of the country which is so essential to the formulation and development of the biological programmes. In order to collect fishery survey data, giving particular emphasis on the pattern of fish stocks in the different zones of the large coastline of India, fishery survey is carried on and field assistants have been posted at selected observation centres. A continuous study is undertaken on the trend of annual changes in fisheries and the fluctuations which are likely to affect the total yield, and incidentally also to gather data for estimating the approximate annual marine fish production in the country. The data gathered are regularly sent to the headquarters where they are analysed and made available to the public. The collection and study of data relating to deep-sea fishing operations has also been initiated at Bombay, Calcutta and other centres.

FISHERY BIOLOGY

The studies relating to fishery biology deal with fish populations, habits, distribution, life histories and such aspects of fish life which have intimate bearing on fisheries problems. The major fisheries of India like the Sardines, the Mackerel, the Prawns and certain less known categories of fishes are all investigated in detail in an attempt to understand the causes governing their abundance and the efficiency with which the fish are caught and utilised. Subsidiary fishery resources like the sharks, the oysters, clams, etc. are also receiving close attention. Apart from exploitation, the conservation of the fisheries is equally borne in mind.

PHYSIOLOGY OF FISH

The physiology of fish and other commercially important forms of marine life are studied with a view to selecting suitable types that would be ideal for large-scale culture in coastal waters which could be developed into marine fish farms. An area of about 150 acres on the Palk Bay side at Mandapam has been acquired where construction of an experimental Marine Fish Farm has been completed for conducting field trials. More extensive experiments in fish cultural operations at other centres are also contemplated. Experimental studies on fish curing and utilisation of by-products have also been initiated. Sea weeds which occur in considerable abundance in the sea and form a valuable raw material for the production of agar and other industrial products are being investigated; experiments have indicated their usefulness as high quality manure and cattle food.

MARINE BIOLOGY

The next important category of investigations comes within the field of marine biology dealing with the factors connected with the abundance of plantation which ultimately form the food of fish. This is also correlated with the studies on the chemistry of sea water with a view to understanding seasonal changes in the occurrence of fertilizing substances in the sea. The acquisition of a fishery vessel for surveys and offshore investigations is under active consideration. Investigations on the bacteriology of sea water and fish products are also undertaken with a view to evolving suitable standards in the handling of fish products.

The Head of the Institution is the Chief Research Officer. The Research Station was started in 1947 with temporary laboratory accommodation in other centres, but the Headquarters at Mandapam was set up in 1949 when the buildings originally put up as a Naval Hospital by the Defence Department during World War II were acquired and converted into laboratories. Subsequently an aquarium with a regular circulating sea water system has been built up for keeping marine organisms for the purposes of study. A library and a reference collection museum have also been set up.

In addition to the Headquarters Station, there is a subsidiary Research Station at Kozhikode to deal with the special fisheries problems of the West Coast of India so well known for the Malabar Sardine and the Indian Mackerel; a Research Unit at Karwar in the Bombay State to deal with the Mackerel fishery and another Unit near Ernakulam in the Kerala State to deal with the prawn fisheries and prawn farming operations. A Research Unit for carrying out investigations on the valuable Molluscan Fisheries (oysters and clams) in the environs of Madras was opened in 1952. In view of the fact that Bombay is developing as a deep-sea-fishing centre, an off-shore Research Unit was set up at Bombay in 1953 and very useful studies on deep-sea fishing operations are being carried out there. The Andhra Fisheries Research Unit at Waltair, the Offshore Fisheries Research Unit at Calcutta, the Research Unit at Mangalore and Research Centres at Vizhingam and Neendakara, though only started recently, have initiated very useful lines of investigations.

The Indian Journal of Fisheries is being published from this institution.

Indicated below are the fisheries research institutes and their substations:

1. Central Inland Fisheries Research Station, Calcutta, (W. Bengal)
    (a) Pond Culture Substation, Cuttack (Orissa)
    (b) Pond Culture Unit, Joysagar (Assam)
    (c) Riverine and Lacustrine Substation, Allahabad (U.P.)
    (d) Lacustrine Unit, Calcutta
    (e) Estuarine Section and Hilsa Investigation Unit, Calcutta (W. Bengal)
    (f) Estuarine Fishery Survey Centres at Kakdwip, Diamond Harbour, Chinsurah, Kolaghat, Port Canning, Indintahat and Aasnabad in W. Bengal and Marsaghai and Kujang in Orissa.
    (g) Hilsa Fishery Survey Centres at Calcutta and Lalgola in West Bengal and Dowleshwaram in Andra.
    (h) Chilka Investigations Unit, Balugan (Orissa)
    (i) Statistical Unit, Calcutta (W. Bengal)
    (j) Training Section, Calcutta (W. Bengal)

2. Central Marine Fisheries Research Station, Mandapam Camp (Madras)
    (a) Central Marine Fisheries Substation, Kozhikode (Kerala)
    (b) Mackerel Research Unit, Karwar (Mysore)
    (c) Prawn Research Unit, Ernakulam (Kerala)
    (d) Mollusc Research Unit, Madras (Madras State)
    (e) Offshore Fisheries Research Unit, Bombay (Bombay State)
    (f) Andhra Fisheries Research Unit, Waltair (Andhra)
    (g) Offshore Fisheries Research Unit, Calcutta (West Bengal)

(h) Central Marine Fisheries Research Unit, Mangalore (Mysore)

(i) Fishery Survey and Research Centres at Gopalpur (Orissa), Adirampatnam (Madras), Nagapatnam (Madras), Pondicherry, Tuticorin (Madras), Vizhingam (Kerala), Allepy (Kerala), Neendakara (Kerala), Verval (Bombay State), Jamnagar (Bombay State) Ratnagri (Bombay State), Nellore (Andhra) and Surat (Bombay State).

FOREST RESEARCH INSTITUTE AND COLLEGES

Dehra Dun (U.P.)

THE Forest Research Institute and Colleges is under the control of the Ministry of Food and Agriculture, Government of India. The work undertaken here is meant primarily to solve the forestry problems peculiar to India. But the Institute also admits students and workers from the neighbouring countries as well. In 1951, the Institute was recognised by the Food and Agriculture Organisation of the United Nations as a centre for technical training in forestry for the South-East Asian region.

The Institute is situated at a distance of 4 miles from Dehra Dun town (latitude 30°, 19 ft. 26 in. N., longitude 70°, 02 ft. 35 in. E.) on the main road to Chakrata. Dehra Dun lies at an elevation of about 2000 feet midway on the plateau between the Himalayas on the north and the Siwalik range of hills on the south. The plateau and the Siwaliks carry deciduous forests of sal, *asna*, *haldu*, *jaman*, *semul*, etc. while the mountains to the north contain pine, deodar, fir and spruce forests.

Forest colleges

The educational activities of the Institute are mainly confined to the Indian Forest Ranger College and the Indian Forest College in which instruction in the theory and practice of forestry is imparted to the freshly recruited rangers and forest officers of the Indian States. The selection of the trainees is done by the States themselves. The ranger course extends over two years while that for forest officers is of three years duration. The Madras Forest College, Coimbatore, is also run by the Forest Research Institute for training rangers for the southern region of India. About 150 rangers and 35 forest officers pass out of these colleges every year.

The teaching staff of the colleges consists mainly of experienced forest officers borrowed from the States. Lectures are also given by the research officers of the Institute in their special subjects.

Research branches

The entire research work of the Institute is organised under two main heads—biological and utilisation. Research on the biological side pertains to the rearing and protection of forests and is carried on in the Silviculture, Botany, Mycology and Entomology Branches while that on utilisation of forest products is undertaken in the Wood Anatomy, Wood Seasoning, Wood Preservation, Composite Wood, Timber Mechanics, Timber Engineering, Minor Forest Products, Chemistry of Forest Products and Cellulose and Paper Branches. The Institute has also got a Service Branch, a Statistical Branch and a Publicity and Liaison Branch.

New Forest Estate

The New Forest Estate in which the Forest Research Institute is located is about 1,100 acres in area. It provides ample space for the future expansion of the Institute. At present a demonstration forest, an extensive aboretum and a botanical garden occupy more than half of the Estate. The main building houses the administrative offices, the Central Library, the Convocation Hall, the Indian Forest College, Museums and the Silviculture, Botany, Mycology, Wood Anatomy, Publicity and Liaison, Entomology and Statistical Branches. The Indian Forest Ranger College, its hostel, the hostel of the Indian Forest College and the rest of the branches with their offices and laboratories, workshops and pilot plants are scattered over the Estate.

History of the Institute

The growth of the Forest Research Institute and Colleges has kept pace with the development of forest policy in India. Before the advent of the British rule and a few decades after, there was in practice no forest policy in the country nor was it realised that any such policy was necessary. The forests were being rapidly destroyed by axe, fire and shifting cultivation. Matters did not take long to come to a head. Acute difficulty was felt in the supply of timber for ship building for the British Navy and later on for the newly laid railways. These two factors aroused keen interest in the forests of India for the first time. But the approach of the Government to the problem was far from realistic. Though it was constantly felt that scientific advice in the management of forests was becoming an urgent necessity, nothing was done in the direction. For example, the first Conservator of Forests appointed in 1806 to look after the exploitation of the Indian forests was a policeman, Captain Watson by name. Little wonder, the post was abolished a few years later.

Imperial Forest School. On the recommendations of Dr. Dietrich Brandis, the Government in 1867 introduced a system under which the probationers selected for the Superior Forest Posts (later on called Indian Forest Service) were to be trained in Germany and France. In India too a forest school was started at Dehra Dun in 1878 by the Government of the then North-west Provinces for giving a two-year course of training to rangers. This school, which was taken over by the Central Government in 1884 and named as the Imperial Forest School formed the starting point of the present Forest Research Institute and Colleges. The training of rangers has been going on here regularly except for a break of two years from 1932-34 when recruitment of rangers was stopped on account of the world-wide depression.

Imperial Forest Research Institute and College. By the end of the last century the school had become a highly efficient institution with a fine museum, herbarium collections, a laboratory, a resin distillery and an instructive arboretum. In 1906, a research department was added to the school and it was redesignated as the Imperial Forest Research Institute and College. The administrative head of the new organisation was designated as the President. The Inspector-General of Forests acted as the first President in addition to his own duties. The two posts were, however, separated in 1908.

Provincial Forest Service Class. As a result of the Government's forest policy, the forest departments were expanding. This necessitated the recruitment of a large number of trained forest officers. To meet this need a Provincial Forest Service was inaugurated in 1891 appointments to which were made by promotion of rangers of proved merit. With the object of raising the standard of the Provincial Service, a system of direct recruitment was introduced in 1906. Candidates for employment in the Provincial Forest Service were required to undergo a third-year course in addition to the course of two years already existing in the college at Dehra Dun. The system did not prove satisfactory. In 1912, therefore, a separate two-year course was started for the Provincial Forest Service in the Forest College and only graduates in science were eligible for it.

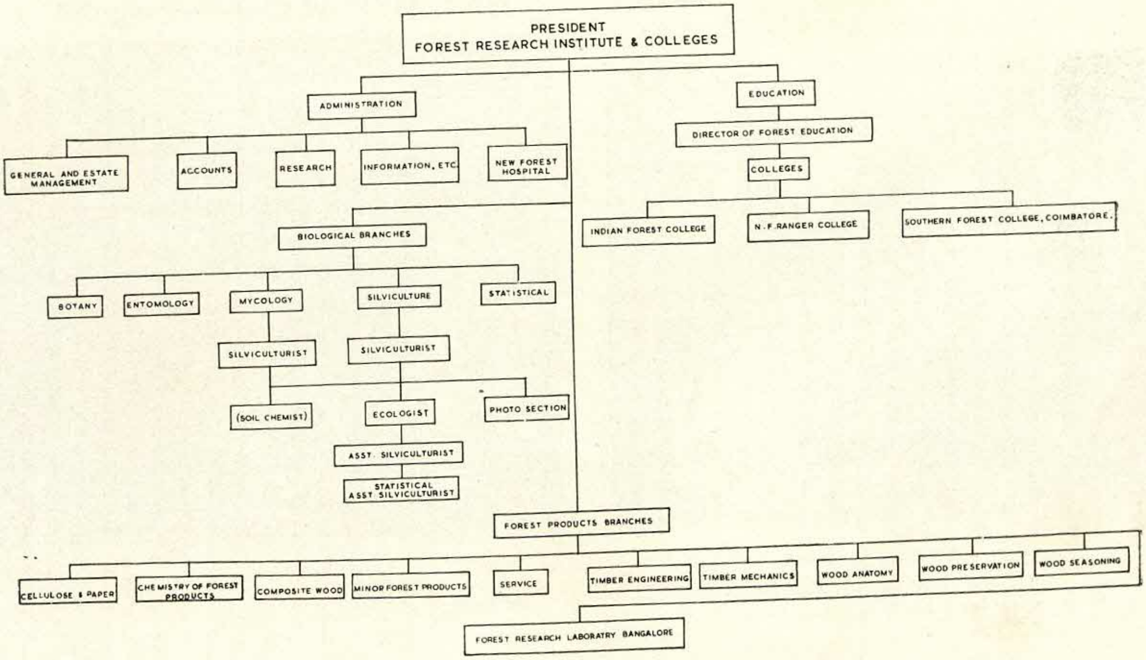
INDIAN FOREST COLLEGE

The Provincial Forest Service course was abolished in 1926 to make room for the Indian Forest Service class for the probationers of the Indian Forest Service who were previously trained in Europe as already mentioned. This was done partly as a result of the large-scale

Forest Research Institute and Colleges, Dehra Dun

FOREST RESEARCH INSTITUTE AND COLLEGES
Dehra Dun (U.P.)

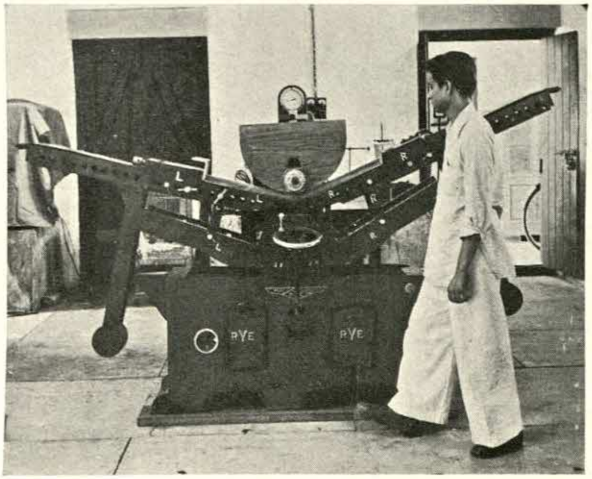
Organisation chart



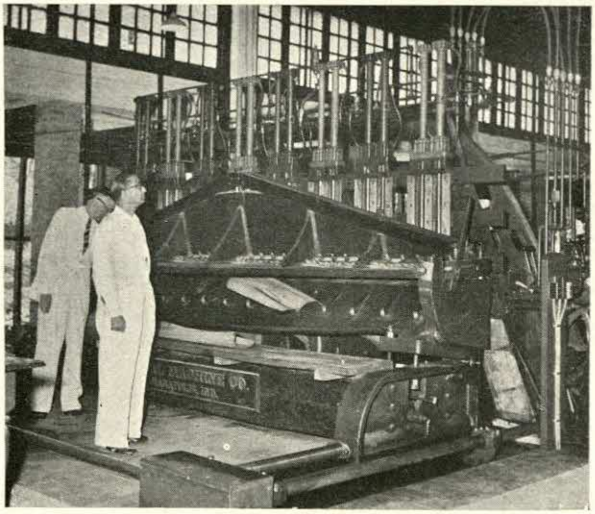
Collection Room, Wood Anatomy Branch, Forest Research Institute, Dehra Dun

Composite wood exhibits, Forest Research Institute, Dehra Dun

Bending operation of wood in the Wood Seasoning Branch, Forest Research Institute, Dehra Dun



Plywood slicer machine installed at Forest Research Institute, Dehra Dun



Indianisation of the Service since 1920 but mainly as all the arguments for keeping it outside India had ceased to carry weight. In 1932, Indian Forest Service class had to be closed down for the same reasons as the Indian Forest Ranger class namely, lack of recruitment, and it was not revived. However, another course was opened in its place in 1938 to train personnel for the gazetted forest services of the various provinces and Indian States. The new course conducted in the Indian Forest College is still continuing.

Growth of forest research

Except for the creation of a post of Reporter on Economic Products in 1887, little attention was paid by the Government of India in the last century to the need for research in forestry. Men like Brandis and Gamble had done eminent work in Forest Botany and given a certain tone to the Indian Forest Department but this was the result of their individual efforts. The Government looked upon the forests as a commercial concern. Through all their correspondence during the last quarter of the past century runs the idea that the Indian forests were maintained for the production of revenue.

Meanwhile things were happening elsewhere which had their reaction on the Indian Forest Department. In 1888, investigations were initiated at the Entomological Museum of Calcutta on the insect pests of crops and stored grains. Not to be left behind, the Forest Department requested that this work be extended to the insect pests of forests as well. Realising the importance of the task the Government of India in 1900 sanctioned the appointment of a Forest Entomologist for two years in the first instance and thus was created the first post for forestry research in the country. But such was the scepticism of the authorities as to the usefulness of reasearch that the post was not renewed after the expiry of two years. However, in 1901 the Government of India ordered the formation of the Agricultural Research Institute. Making use of this precedent, the Inspector-General of Forests (Eardley Wilmot) pressed for the setting up of a forest research centre as well and succeeded in getting Government sanction. Thus in 1906, the Forest Research Institute was established in the Imperial Forest School in Dehra Dun. The research posts created were : (1) Imperial Silviculturist, (2) Imperial Superintendent of Working Plans, (3) Imperial Forest Zoologist, (4) Imperial Forest Botanist, (5) Imperial Forest Economist and (6) Imperial Forest Chemist. Later on, the post of Superintendent of Working Plans was transferred to the Office of the Inspector-General of Forests. The designation of the Forest Zoologist was changed to Forest Entomologist in 1922 and that of the Forest Economist to Utilisation Officer in 1937.

Expansion of the Institute

As accommodation in the old school was not enough the Institute moved in 1914 to Chandbagh, Dehra Dun, a 47-acre estate in which extensive buildings, costing over half a million rupees, were erected to house it. Then came the war of 1914-18. During this war, although the Institute did creditable work, both its staff and equipment were found insufficient for meeting the various calls made on it. The Industrial Commission of 1916-18 also laid stress on the necessity of expanding the activities of the Institute for the development of forest industries. So, under a new scheme of 1920-21, the Forest Economy Branch was reorganised, and new Sections of Wood Technology, Minor Forest Products, Paper and Pulp, Mechanical Engineering, Wood Working, Wood Seasoning, Timber Testing and Wood Preservation, etc. were added to it.

Chandbagh Estate was not considered spacious enough for the requirements of the Institute under the new scheme. The site occupied by the Institute at present was bought. Experts were sent abroad to order up-to-date laboratory and workshop equipment, and construction of the buildings which took several years to complete, was started immediately. Officially the Institute occupied the new buildings in 1929. This arrangement continued till the break of the last World War.

In that war, wood proved itself to be a matter of great economic and strategic importance. In addition to its well known uses, trees served as a substitute for metals, their fruits source of food for man and beast, and raw material for motor fuel, textiles, plastics and many other things. New techniques were developed for the intensive utilisation of forest produce and the integration of forest industries. It was realised that a country having sufficient forests could almost be made blockade proof in war.

Reorganisation scheme

The last World War again found the Forest Research Institute inadequately organised for it. Another reorganisation scheme estimated to cost about 6 million rupees and to be completed in five years was drawn up in 1946. Due to the financial stringency prevailing in the country, the scheme could only be partially implemented. A Statistical Branch and a Publicity and Liaison Branch were established in 1947. In order to afford full scope of development in each field of investigation, the Utilisation Branch was split into a number of independent branches. In 1950, a few branches were bifurcated and in 1953 a new Timber Engineering Branch was opened. A modern plywood plant including a slicer was erected for the Composite Wood Branch, a laboratory and an automatic controlled experimental kiln was set up for the Wood Seasoning Branch and a building to house another laboratory was constructed. The paper plant is still to be set up. New machinery was installed in the Iron Workshop, the Saw Mill and the Wood Workshop.

Research programme

All research in the Institute is carried out according to a quinquennial programme, which is referred to the Central Board of Forestry. Since 1918, the work of the Silviculture Branch is also placed before the Silvicultural Conference for consideration. The Conference is held at intervals of five years and is attended by the silviculturists and the senior forest officers of States.

CENTRAL ADVISORY BOARD ON FOREST UTILISATION

At the instance of the Board of Forestry, the Government of India in 1939 formed the Central Advisory Board on Forest Utilisation for co-ordinating the research work carried out in the Institute with the needs of commerce, industry, and the general public. At the periodic meetings of the Board the programme of research of the Forest Products Branches is submitted for advice. Since the Advisory Board could not meet frequently, an Executive Committee of the Board was instituted in 1952 under the chairmanship of the Director of Scientific and Industrial Research, Government of India, to carry on the work of the Board continuously.

PUBLICATIONS

In addition to permitting research articles to appear in scientific and technical journals, the Institute issues forest records, forest bulletins, forest leaflets and pamphlets. The Institute also publishes annual reports, manuals and treatises.

In the field of forestry research, the Institute occupies a position of prestige in the scientific and technical world. Its workers enjoy international reputation and several of them have been offered responsible posts in similar institutions in other countries. In the utilisation of forest produce for the industrial development of the country, the contribution of the Forest Research Institute is by no means insignificant. The establishment of some very important industries has been made possible as a result of the investigations carried out in the Institute.

SILVICULTURE BRANCH

In the Silviculture Branch are studied the rates of growth of different kinds of trees. From the data so collected are obtained volume, yield and stand tables. The tables are essential for the correct exploitation of a forest which implies that the timber removed should be in balance with the growth increment of the standing trees. Without the help of such tables there is always a danger of over-exploitation.

The Branch has published volume, yield and stand tables for most of the commercially important timbers of India. On the experimental side it has accumulated information on the many timber species regarding seeding time, seed collection, plantation methods, natural regeneration and other items concerning crop replacement and development. These experimental studies also extend to the ecological relationship of plants with their environment and the problems connected with soil erosion and its control. The Branch maintains close relations with the State Silviculturists, supplying them with necessary technical assistance co-ordinating the results of research and acting as a clearing house for technical information from all over the world.

The Branch has a silviculture museum, a demonstration area and experimental gardens under its control.

HERBARIUM

Correct identification of plants is a prime necessity especially in a country like India whose forests possess a large variety of trees, shrubs and herbs. This is the main function of the Botany Branch which has a herbarium of an ever-growing collection of authentic specimens, one of the best in the East for the purpose. Besides embodying the bulk of the Indian flora, the collection contains specimens of plants from all over the world.

BOTANY BRANCH

An arboretum and a botanical garden possessing a large number of exotic and indigenous plant species are attached to this Branch constituting further aids to botanical studies and identification. The Branch also undertakes collection and distribution of seeds of forest species for experimental work. In recent years the Botany Branch has been working on the application of the principles of genetics and plant breeding to forest species. In 1952 it took part in the expedition to the Great Nicobar Islands for a survey of the local vegetation.

TREE DISEASES, TIMBER DECAY AND THEIR CONTROL

The Mycology Branch specialises in investigations of tree diseases and timber decays caused by fungi with a view to evolving methods of control. Although mycological work was started in the Institute as early as 1911, systematic study of pathogenic fungi was not taken up intensively till 1927 when a Mycology Section was formed with a fully qualified Mycologist as its head.

Investigations on rusts on *Pinus longifolia*, *Pinus excelsa*, *deodar*, spruce and fir have been undertaken and their host parasite relationship with stem and needle rusts has been established and remedial measures suggested. The fungal diseases of the important species *Sal* (*Shorea robusta*) have been studied and a great deal of work has been done on wood rotting fungi in general.

The Mycology Branch has a museum of forest pathology displaying specimens of fungi causing damage to trees and timber and a fine collection of cultures of forest fungi. This Branch forms one of the centres of the Indian National Committee on Type-Cultures of Micro-organisms.

Insect pests of forest and products

It has been said that forestry is 90 per cent protection. Insects constitute one of the principal agents of destruction to forests and forest products. The chief function of the Entomology Branch is to reduce the losses to forest trees and forest products caused by harmful insect pests. To carry out this task successfully, this Branch engages in three major activities.

The first activity is to study the ecology of insects which attack forest trees from seedling stage to maturity, to estimate the extent of damage they cause and to devise cheap and practical methods of control under different conditions. This work is carried out both in the temporary field laboratories and in the insectory attached to the Branch. The second activity deals with systematic entomology involving the identification, maintenance and expansion of the main reference collection of insects in the Branch which contains 20,000 authentic specimens. Under the third activity, the Branch maintains the entomological and zoological museums where life histories of the important forest insects, together with samples of damaged products and zoological specimens are exhibited.

The Branch has evolved control measures for the toon shoot borer, *sal* borer and the teak defoliator. Intensive work has been done on the spike disease of sandal. Investigations have been started on the efficacy of the prophylactic treatment of timbers, bamboos and plywood for protection against borers. Recently a small termite laboratory has been set up to deal with the problems of termite identification and damage.

Important works done

Wood anatomy and timber utilisation. Wood Anatomy is rightly described as the fundamental basis of timber utilisation. Not only do the anatomical features of a wood identify it but they also provide a broad idea of its physical and mechanical properties. Thus on the one hand a wood anatomist helps the wood industries in obtaining the specific timbers they require, on the other, he suggests likely uses for those woods which are not in commercial demand.

Wood collection. The Wood Anatomy Branch has carried out anatomical studies on Indian wood, from the point of view of their utilisation. These studies have a special significance for a country like India which contains only a few well known timbers and a large number designated as jungle woods. For the purpose of reference, the Branch has one of the finest timber collections in the world at present comprising about 15,000 indigenous and foreign wood samples.

Aid to Defence Service and other Departments. In the last war this Branch produced several publications for the Defence Services like a series—*How to identify timbers*—a book on timbers used in the various areas of military inspection and a pocket guide on Burma timbers. The Branch also devised a simple method for selecting good quality fir and spruce and thus helped the Air Force by providing suitable material for the repair of wooden aircraft. Another work of considerable importance done during the war was the discovery that red cutch (*Acacia chundra*) could be used for tail shaft bearings of ships in place of *Lignum vitae*, the only timber hitherto known to be suitable for this purpose.

By identifying fossil woods and plant remains received from the Geological and Archaeological Survey of India, the Branch is attempting to throw light on the vegetation and climate of this country in the recent past—about 5,000 years ago. A discovery of charred paddy along with charcoal has established the existence of the oldest rice in the world belonging to the Hastinapur Civilisation. Incidentally this find may be of interest to plant breeders since it represents at least one of the rices from which the present day varieties have been evolved.

The Branch handles enquiries received from industries for advice on the identification of timber or suitability for specific purposes. It is also called upon to suggest substitutes for imported species.

Improved wood. The Composite Wood Branch undertakes to study the problems of improved wood like plywood, compregnated wood, building boards, etc. These studies help us not only in devising methods for overcoming the disadvantages of natural wood, like working with changing atmospheric conditions, defects like knots and inclined grain, dearth of large size in clear grade, anisotropy and lack of strength balance, etc. but also for improving its properties so that lower grades of timber are upgraded, new fields of application are opened, substitutes for foreign woods are provided and finally a standard engineering product tailored to the job is made available.

The work of the Branch is of immediate interest to the railways, ship-building and air-craft industries, telegraph, telephone and electricity industries, chemical, adhesives, plywood, sports goods, textile, building and several other industries.

The various processes of improving wood, viz. compression, impregnation with resins or chemical modification, lamination and a combination of the three are engaging the attention of the Branch. Laminated wood has been tried for picker arms, skis, foot-rules, slide-rules, rifle half-wroughts, etc. with success.

Compregnated wood even from inferior species like *semul* and *toon* produced in the Branch has been found to be suitable for exacting jobs like those of air screws, fish plates, shuttles, bearings, gears, printing requisites, etc.

Adhesives in timber utilisation. The work of modern adhesives has greatly extended the use of wood for technical architectural, and decorative purposes. The Branch has developed satisfactory adhesives from various proteins, seed cakes and coconut shells, etc. As aid to the plywood industry and to conserve timber supplies, Indian species have been examined for their suitability for plywood or other forms of composite wood matches, etc. and the best methods of manufacture are determined. With modern equipment and technique, it has been found possible to utilise species hitherto considered unsuitable.

Bamboo boards. The Branch is actively engaged in the production of building boards from bamboos, veneer strips, and wood and agriculture wastes by thermal plasticisation and other physical and chemical processes.

Seasoning of timber. Before use the timber has to be dried properly. If used undried or improperly dried, the finished article after some time tends to develop surface cracks or goes out of shape. Adoption of correct procedure of seasoning is, therefore, essential for the efficient utilisation of timber.

The Wood Seasoning Branch has designed a number of air-seasoning sheds and seasoning kilns including veneer dryers. It has carried out investigations on the air seasoning of various Indian timbers, railway sleepers, poles, bamboos, willow for cricket bats and artificial limbs, etc. It has drawn up kiln seasoning schedules for most of the commercially important species of the country.

Jute and textile mill bobbins. In co-operation with the old Wood Working and Timber Mechanics Branch, the Wood Seasoning Branch has devised 3-ply end jute mill bobbins which are now being industrially produced. Likewise another industry of battery separators has also come up in the country. As a result of the improvements effected by proper seasoning and selection of blanks for making cotton mill bobbins from *haldu*, the Government of India on the advice of consumers and manufacturers, have stopped the imports of slubbing and roving bobbins and skewers by 60 per cent. The Branch has also developed a set of tools for making pencils by hand.

Research in some of the fundamental aspects of timber physics including steam bending has been undertaken here. The Branch is equipped with half a dozen different types of seasoning kilns, humidity chambers and a wood bending machine.

Wood preservation. A forest is an inexhaustible store of raw material and only a small fraction of it is being exploited by the industry at present. Among the large number of tree species in the Indian forests, there are only a few which supply durable timbers. If the material from the rest could be rendered utilisable, the timber shortage in the country will be considerably reduced.

One of the immediate problems before the country at present is the raising of the standard of living of the people. This is not possible without rapid and large-scale industrialisation for which steel, the most important raw material is required in a very large quantity. India's output of steel is far below even her present demand. Therefore, substitutes for steel have to be found out. Timber is one such substitutes.

Inferior timber as substitute for steel. Researches carried out in Wood Preservation Branch prove that the service of the perishable woods can be increased from 5 to 10 times and they can be used in place of steel for railway sleepers, electric transmission poles and for structural purposes. The Branch has done work on the preservation of thatch and bamboo, thus enabling them to be used as cheap house building material. Recently the Branch has devised a portable plant for giving preservative treatment to green bamboos and light timbers.

Ascu the well-known water soluble preservative was developed in the Wood Preservation Branch which has also developed a fire proof-*cum*-antiseptic composition from indigenous material and wood preservatives from chir pine resin and non-edible oils.

The Branch is equipped with pilot plants both for giving pressure and non-pressure preservative treatment to timbers and a laboratory for the testing of the wood preservatives.

Timber Dryers' and Preservers' Association. In 1952, the Wood Preservation and the Wood Seasoning Branches started the Timber Dryers' and Preservers' Association of India, thus bringing together the research worker, the industrialist and the consumer of treated and seasoned wood.

Use of small dimensioned stock. The quantity of timber required for structural purposes is far more than used anywhere else. Economy in the use of timber for this work is thus a problem of paramount importance. Components of a timber structure are generally large in size. As clear large sized material is more costly and less available, the utilisation of small dimensioned stock for structural purposes is a fruitful field for timber research.

The Timber Engineering Branch prepares economical designs of timber structures especially those in which the small timber specimens can be used. The Branch also investigates the strength properties of these structures. It has already constructed a 3-hinged arch nail jointed timber shed and has carried out tests on the German methods of nailing for Indian conifers.

Use of right species. The rational timber utilisation requires that the right species should be used for a particular job. To achieve this, it is necessary to know the various strength properties of timbers and other physical characteristics like density, stability of shape, etc. The Timber Mechanics Branch collects data on these lines in conformity with international standards and deduces from this data the possible uses to which a timber can be put. The work of the Timber Mechanics Branch is of great help in finding the suitability of our little known species for commercial purposes as well as substitutes for imported timbers.

Ammunition boxes. The Branch has evolved wooden disc dowel joints which can be used cheaply in place of wire strips, gussets and bolts commonly employed in wooden structures. It has shown that cheap timbers like mango and *salai* can be used for ammunition boxes in place of teak. For some time past, the Branch has been working on bamboos to test their usefulness as substitutes for timber. The Branch has a well-equipped timber testing laboratory.

Paper industry and the Institute. The Cellulose and Paper Branch is the only place in India where organised research is being done on the utilisation of forest produce and industrial and agricultural wastes for the production of pulp, paper and boards. First of all the investigations are carried out on the laboratory scale. Those found promising are tested on pilot plant either in the Institute or outside. Successful results are communicated to the paper industry.

The paper manufacture in India depends mainly upon bamboo and sabai grass for the raw material. This was made possible by the researches conducted in the Forest Research Institute. Recent work done in the Branch on bagasse has been taken up for commercial exploitation for the production of good quality paper.

The special feature of the Branch is that it undertakes to impart training in paper and pulp technology to the apprentices deputed by the paper mills and the Government departments. These facilities are being expanded and a systematic and comprehensive course is under preparation. The Branch also brings out a quarterly 'Technical Abstract' containing information collected from various journals for the benefit of the paper industry.

The Branch is receiving voluntary contribution from the varoius paper mills for the technical service rendered and its research programme is formed in consultation with the Technical Sub-Committee of the Advisory Body of the Indian Paper Industry.

Minor forest products. Besides timber and fuel wood, there are numerous other forest products derived from over 3,000 species of plants which play an important role in the economy of our country, both rural and industrial. These so-called minor forest products constitute roughly 30 per cent of the total forest wealth of India and earn a foreign exchange of over Rs. 400,000,000 annually. The numerous raw materials in this field of investigation include plants yielding medicines, drugs, essential oils, gums, resins, tans, fatty oils, dyes, waxes, edible products, fibres, flosses, etc. There are besides the grasses, bamboos and canes which lend themselves to use in a variety of ways.

The Minor Forest Products Branch is engaged in economic research on these plants, covering their distribution and availability, methods of collection, extent of trade, scope for demand, adulteration, grading, marketing, etc. with a view to suggesting improved methods for their utilisation and supplying raw materials of standard quality to the trade and industry of the country and the overseas market. It also undertakes experimental cultivation of promising exotic and indigenous plants.

Among the achievements of the Branch may be mentioned the establishment of artemisia and santonin industry in India, researches on improved methods for charcoal manufacture including the designing of a portable kiln and the cultivation of economic plants like ocimum, sarpagandha, santonin yielding artemisia, citronella grass, blue mallee, etc. A fine museum on minor forest products is run by the Branch.

Chemical extraction from forest produce. The Chemistry of Forest Products Branch deals with chemical investigations of forest produce and the study of the properties and uses of their constituents. It also works on the development of economical methods of extraction and isolation of marketable products from the forest produce.

The researches carried out in this Branch have resulted in the establishment of a number of industries in the country like production of turpentine and rosin and more recently sizing material for the jute and textile mills from tamarind kernel powder. The latter has replaced the use of cereal starch for the purpose.

The Branch has also done useful work on the isolation of Kamala oil from the seeds of *Mallotus philippinensis*, chlorophyll extraction, essential oil from deodar and costus roots, etc. It has a pilot plant for the distillation of essential oils and a well equipped library for investigations on plant products.

Standardisation of research methods. Modern methods of research require that experiments should be so designed that the data can be subjected to statistical methods of analysis and interpretation. The scope of work of the Statistical Branch includes the vetting of experimental designs and statistical analysis and interpretation of results for all research branches of the Institute. It advises the State Silviculturists on experimental designs, assists them on a limited scale in the analysis of data and also gives advice to the State Forest Departments on sampling techniques for the surveys of forest resources.

Service Branch. The Institute has an efficient Services Branch the main functions of which are to do service work for other branches like the installing of pilot plants and machinery, repair and maintenance work, preparation of test specimens for experimental work, etc. The Branch has an Iron Workshop, a Saw mill and Wood Working, Electricity and Boiler Sections.

The Wood Working Section in addition to doing service work, studies the wood working qualities of the Indian timbers and prepares furniture of new designs. Its programme also includes investigations on the economic conversion of timber and the designing of modern wood working machinery.

Publicity. In brief the investigations undertaken in the various Branches of the Forest Research Institute are directed towards the development of techniques for increasing the yield of suitable forest produce and its efficient utilisation. Since the results of these investigations are of interest to the forest departments of the States, industries of the country, general public and other research organisations, it is extremely important that the Institute should have an active liaison with all of them. This work is assigned to the Publicity and Liaison Branch.

The publications of the Forest Research Institute are distributed according to a mailing list in which the forest departments, industries and the research organisations are adequately represented. The results of important researches are given publicity in the daily press.

Brief notes written in non-technical language on the work of outstanding interest undertaken in the Institute are sent to the Ministry of Food and Agriculture, Government of India, every month and every quarter for publicity purpose.

Annual Research Reports on the Institute and on the Forest Departments of States are also published and distributed. A review on the progress of forest products research in the Institute for the 1948-53 quinquennium was printed as a popular pamphlet.

Exhibits and exhibitions. Exhibits, pictorial posters, photographs, models, etc. concerning the activities of the Institute are displayed at the important exhibitions held in the country. The Branch is also maintaining a timber museum exhibiting various aspects of timber utilisation.

Films pertaining to forestry and forest products are purchased and loaned to the various industrial and educational organisations on request.

Data on forests and forest products are also collected from the States for the information of research workers in the Institute.

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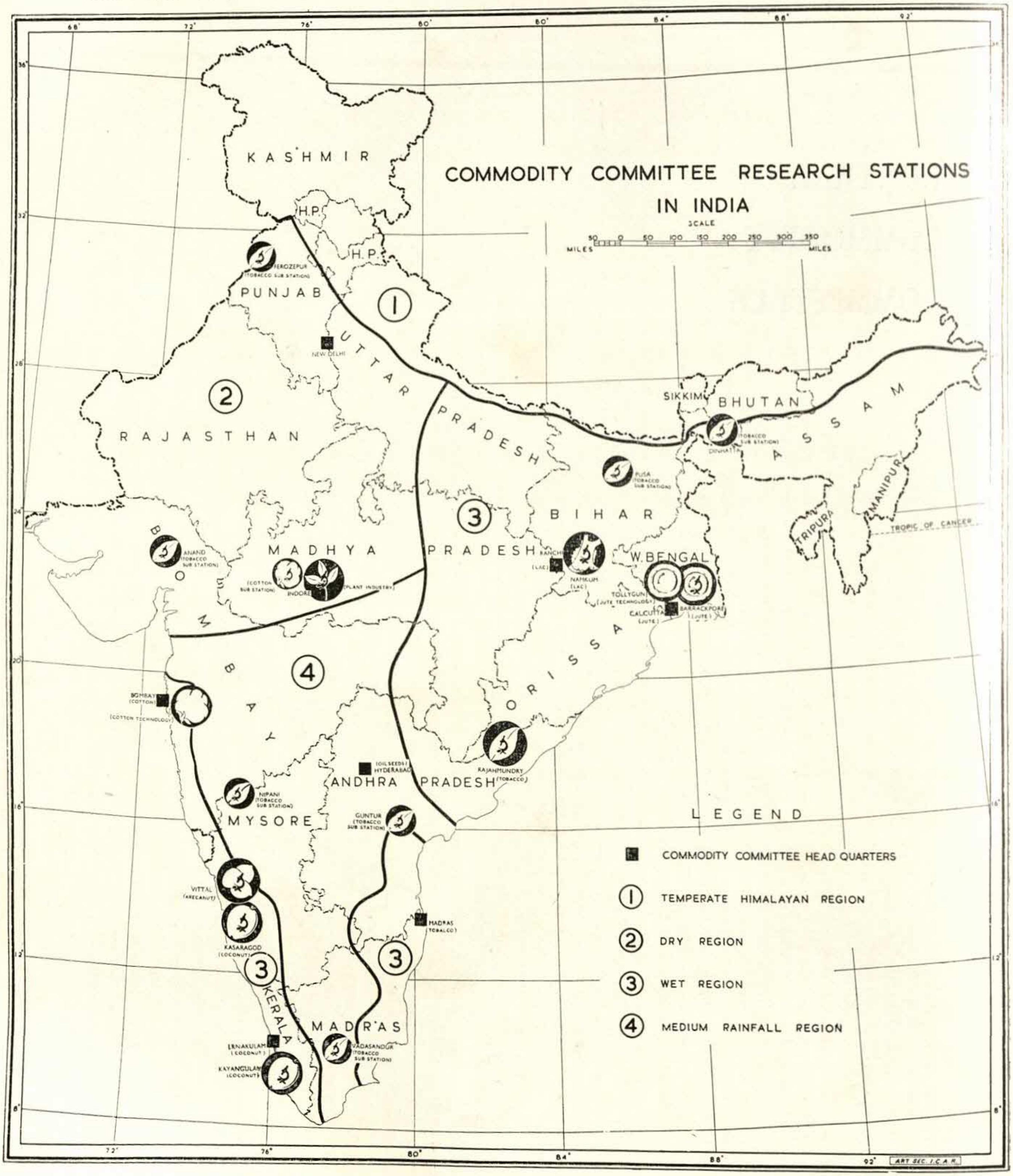
CENTRAL
COMMODITY
COMMITTEES

PLATE XXXIV]



COMMODITY COMMITTEE RESEARCH STATIONS IN INDIA

INDIAN CENTRAL COTTON COMMITTEE

Headquarters—Bombay (Bombay State)

IN pursuance of the recommendations of the Indian Cotton Committee of 1917-18, with the object of securing co-ordination and co-operation in all matters relating to cotton, the Indian Central Cotton Committee was established by the Government of India in 1921.

During the first two years of its existence, the Committee was purely an advisory body to Government on matters connected with cotton. In 1923, however, the Committee was incorporated under the Indian Cotton Cess Act and provided with separate funds to enable it to undertake work for the improvement of growing, marketing and manufacture of cotton in India.

The Indian Cotton Cess Act of 1923 was amended in 1948 with a view to enlarging the functions of the Committee, so as to include in its purview the improvement and development of methods of growing, manufacturing and marketing of Indian cotton.

Source of Finance

The Indian Cotton Cess Act of 1923 provided for a compulsory levy of a cess of 2 annas (4 annas for the first three years) per standard bale of Indian cotton either exported from the country or consumed in the mills in India. By the Indian Cotton Cess (Amendment) Act, 1947, the cess was made applicable to imported cotton also. By a further amendment of the Act, made in 1948, the cess of two annas per bale was raised to four annas per bale. Further, from the 1st April, 1951, the provisions of the Indian Cotton Cess Act were extended to all the States. Besides the income from this cess, the Committee receives from time to time special grants from the Government of India's Cotton Fund which was built up from the proceeds of the import duty on raw cotton, imposed by the Cotton Fund Ordinance (VIII of 1942).

Funds of the Committee

The total receipts of the Committee from its inception to the year ending 31st March, 1956, are as given below:

	Rs.
(i) From cotton cess	2,51,59,946
(ii) From Cotton Fund	79,71,756
(iii) From miscellaneous sources	43,80,814
Total	3,75,12,516

Annual income

The annual income of the Committee during the past five years is tabulated below:

	Rs.
1951-52	11,54,060
1952-53	12,22,366
1953-54	12,96,466
1954-55	12,88,636
1955-56	15,08,478

How funds are spent

The funds at the disposal of the Committee are allotted for research on cotton problems of all-India importance, and for the development, extension and marketing of improved varieties of cotton in various tracts.

The general policy of the Committee is to give assistance in the directions where it is mostly needed in carrying out work of co-ordinating research on cotton improvement. This policy is carried out by means of subsidies sanctioned to Departments of Agriculture in various cotton growing States for investigations on specific problems relating to cotton.

Pattern of financial assistance

Until 1937, the entire expenditure on the various schemes was borne by the Committee, but in view of the gradual depletion of its reserve fund it was decided that the State Governments should accept increasing responsibility for the schemes financed by the Committee, which at the end of their sanctioned period, were expected to produce beneficial results.

The Committee finances research schemes in full up to a period of 10 years and on a 50:50 basis for the next five years. After such schemes have been in operation for 15 years, the Committee's contribution is stopped altogether and they are taken over completely by the State Governments.

All research schemes aimed at producing cottons of 1-1/8 inch staple and above, are financed by the Committee in full for a period of 15 years.

The expenditure on seed distribution schemes is divided into (1) cost of staff and (2) incidental charges on the distribution of seed of approved varieties. The Committee bears either the cost of staff or the incidental expenditure whichever is less. The seed distribution schemes are sanctioned by the Committee for a period not exceeding five years in the first instance, but they may be extended subsequently for a further period of five years on the condition (a) that the Committee's share of the expenditure on the second period does not exceed 75 per cent of either the pay of the staff or incidental expenditure whichever is less and (b) that the State Government concerned contributes not less than the sum spent by it during the original period of the scheme. After seed distribution schemes have been in operation for a period of 10 years, the contribution of the Committee during the next five years is limited to 33 per cent of the cost of the staff or incidental expenditure, whichever is less, subject to a maximum of 15 per cent of the total cost of the scheme during the extension period.

SCHEMES DEALT WITH BY THE COMMITTEE

The investigations financed by the Committee include the following:

(i) Botanical schemes for breeding high-yielding superior types of cotton ;

(ii) Entomological schemes for the study of the life history of important cotton pests and measures to control them ;

(iii) Mycological schemes for finding ways and means to prevent loss due to fungus infestation ;
(iv) Physiological schemes for the study of crop growth ;
(v) Agronomical schemes for determining the manurial requirements of the crop ;
(vi) Statistical schemes for the study of the various factors that contribute to the collection and interpretation of statistical data on cotton.

Grants are also made by the Committee for the extension and marketing of improved varieties of cotton and the maintenance of nucleus stocks of pure seed of approved strains for which the seed distribution schemes are not operating.

ORGANISATION

The Committee has, on its general body, representatives of cotton growers, agricultural officers, cotton traders, textile industry, co-operative banking and cotton ginning and pressing industry. The Committee has been an invaluable forum for the discussion of many problems affecting both cotton production and cotton trade.

The Committee's primary concern, however, is the interest and welfare of the cotton grower.

The Vice-President of the Indian Council of Agricultural Research is the ex-officio President of the Committee.

SUB-COMMITTEES

To facilitate disposal of the work of the main Committee, the following Sub-Committees are appointed, annually before the commencement of the financial year, to hold office from the 1st April to the 31st March of the succeeding year :

Standing Finance Sub-Committee

This is the principal executive body of the Committee and consists of nine members, including the President and Vice-President who are ex-officio members.

The Vice-President is the ex-officio Chairman of the Sub-Committee. It exercises all powers of the Committee in regard to the control and the disposal of the funds of the Committee, and deals with the day-to-day administration and all matters involving finance.

Local Sub-Committee

It is composed of local members and those residing near about Bombay, and deals with matters of a general nature, not involving finance which cannot be postponed for consideration to the usual half-yearly meetings of the full Committee. There is no limit regarding the total number of members on this Sub-Committee.

Agricultural Research Sub-Committee

It is an advisory body to the main Committee on matters relating to research on cotton and extension of successful results of research in agricultural practice. It reviews the progress made under the various research, seed distribution and marketing schemes of the Committee, and examines proposals for new schemes or extension of the old ones.

Technological Research Sub-Committee

This is an advisory body to the main Committee on matters relating to technological research.

Cotton Forecast Sub-Committee

This Sub-Committee deals with the questions relating to cotton forecasts and cotton statistics.

Cotton Ginning and Pressing Factories Sub-Committee

This Sub-Committee attends to matters arising out of the operation of the Cotton Ginning and Pressing Factories Act, 1925.

STAFF

A full-time Secretary functions as the Chief Executive Officer of the Committee, and is assisted by a Deputy Secretary and an Assistant Secretary in the discharge of the Committee's day-to-day work.

ACHIEVEMENTS

As a result of research work relating to cotton improvement, 61 improved varieties of cotton have been evolved since the inception of the Committee. These have been bred in successive years and the staple quality of the Indian cotton has, with the extension of these varieties, been considerably improved as will be evident from the following table:

Production

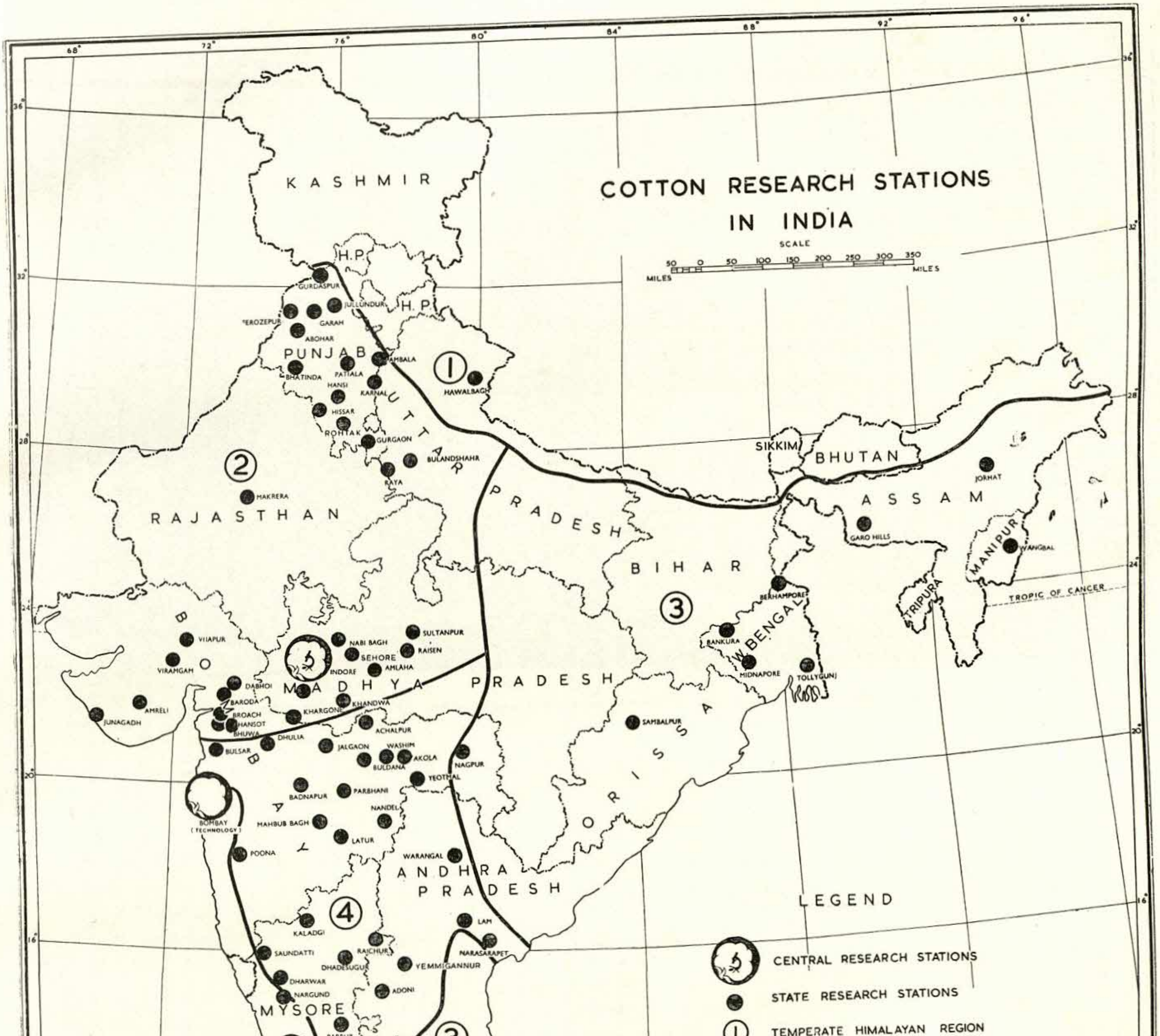
(In thousand bales of 392 lb. each)

	Long staple (7/8 in. and above)	Medium staple (Below 7/8 in. and above 11/16 in.)	Short staple (11/16 in. and below)
	(Before partition)		
1922-27	707	1,612	3,241
Percentage	13	29	58
1942-47	1,776	1,963	1,062
Percentage	37	41	22
	(After partition)		
1947-48	319	1,124	745
Percentage	15	51	34
	(Beginning of the First Five-Year Plan)		
1951-52	918	1,223	992
Percentage	29	39	32
	(End of the First Five-Year Plan)		
1955-56	1,522	1,778	698
Percentage	38	45	17

Profit to cotton cultivators

It is due to the seed multiplication and distribution schemes that the results of cotton improvement work financed by the Committee have been carried to the cotton cultivators. They are, thus, a real link between the experiment station and the cotton farm.

The area under the improved varieties extended over 13.6 million acres during 1955-56 or, in other words, 67 per cent of the total acreage in the Indian Union.



COTTON RESEARCH STATIONS IN INDIA

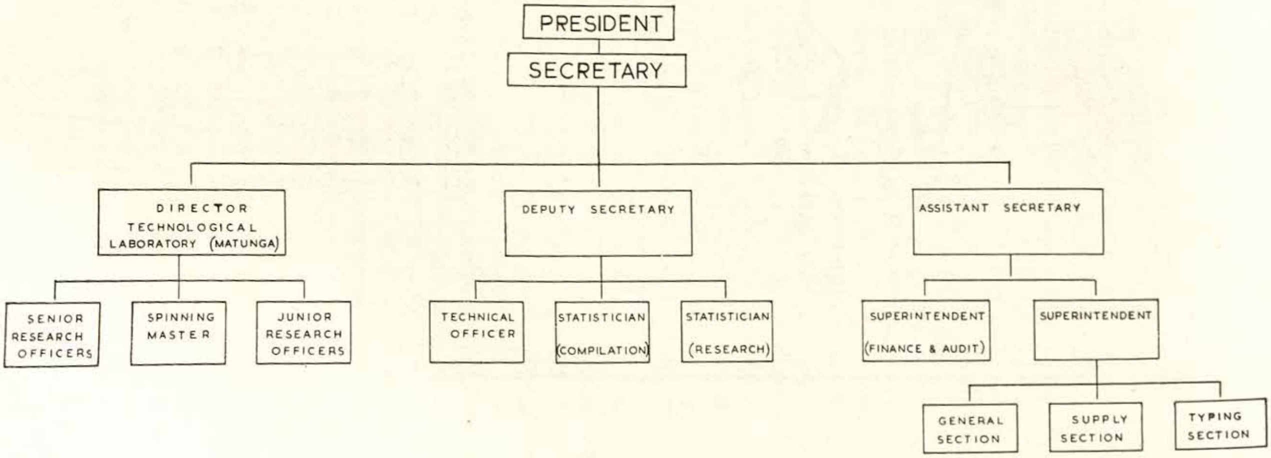
PLATE XXXVI]

Technological Laboratory, Central Cotton Committee, Matunga (Bombay)

INDIAN CENTRAL COTTON COMMITTEE

Headquarters—Bombay (Bombay State)

Organisation Chart



Assuming the additional returns gained by the cultivation of improved varieties at Rs. 10 per acre on an average, the total additional income earned by the cotton cultivators of the improved varieties in 1955-56 was of the order of 13.6 crores of rupees, which is more than three times the amount spent by the Committee on cotton improvement during the last 34 years.

Improvement in yield. The study of cotton yields and the methods of improving them in the different cotton growing areas, though complicated by the fact that most of the cotton crop is grown under rain-fed conditions—and the vagaries of the monsoon are so well known—have been pursued in different localities. The average yield of cotton per acre in India before and after partition are given below.

Yield of cotton per acre

Period	Yield per acre calculated from approximate commercial crop (lb.)
1922-27	96
1927-32	95
1932-37	108
1937-42	109
1942-47	113
1947-52	93
1952-53	92
1953-54	104
1954-55	114

Physiology. The causes of periodical partial failures of the American cotton crop in the pre-partition Punjab have been found out and remedial measures by the application of nitrogen in the form of sulphate of ammonia, or by changing the date of sowing and spacing have been recommended, to minimise such crop failures.

Agronomy. The work on the manuring of cotton crop has been reviewed and direct manuring of cotton crop recommended in both rain-fed as well as irrigated areas.

Pests. Research on pests such as spotted and pink boll-worms, cotton stem-weevil, jassids, aphids, black-headed cricket, white fly and leaf-roller had been undertaken and control measures recommended for each of the pests in the different cotton growing areas.

Diseases. Diseases like wilt and root-rot have been thoroughly investigated and control measures suggested. Breeding for resistance to wilt and the adoption of agronomic practices like inter-cropping of *moth* and sorghum with cotton for the control of root-rot have now been accepted in the affected areas. The work on breeding for resistance to wilt has resulted in the evolution of several strains which combine resistance to disease with desirable economic characters—these are *Vijay, Digvijay, Suyog, Vijalpa, Jarila, Virnar, Jayadhar, Jayawant, Broach Desi* 8 and H. 420.

Technology. The evolution of several improved strains was assisted by the Technological Laboratory of the Committee where testing of cotton fibres and spinning tests on the new types are carried out. The Laboratory has developed a micro-spinning technique which enables very small samples as are available in early stages of breeding to be tested.

The Laboratory test results on standard and commercial types of cotton of each season are made available to the cotton trade in India and abroad.

Research on the improvement of ginning of Indian cottons is also carried on at the Technological Laboratory.

Statistics. Reliable statistics pertaining to the supply and distribution of cotton are disseminated by the Committee by the publication of Statistical Leaflets annually.

Cotton Legislation. The Committee has been instrumental in the introduction of various legislative measures in the different cotton growing areas with the main object of maintaining purity of the varieties released for cultivation in various tracts. The principal Legislative Acts are:

(a) The Cotton Ginning and Pressing Factories Act
(b) The Cotton Transport Act
(c) The Cotton Control Act.

Cotton marketing. The Committee has also been responsible for the improvement of primary marketing by the establishment of regulated cotton markets, and for the inclusion of cotton in the schedule of commodities under the Agricultural Produce (Grading and Marking) Act, 1937, so that specified improved varieties of cotton could be marketed under 'Agmark' seal guaranteeing their purity.

Attainment of self-sufficiency. Partition of India in 1947 gave a set-back to the supply of medium and long staple cottons, particularly at a time when the overall consumption of cotton had increased by cent per cent in 1946-47. This deficiency had since been made good by the end of the First Five-Year Plan, particularly in respect of the supply of long and medium staple cottons required by the Indian textile industry. Thus the policy of making the country self-sufficient in respect of raw cotton supply required by the textile industry has been mostly realised.

Production of extra-long staple cottons. The immediate objective of the Committee is to eliminate the imports of extra-long staple cottons of 1-1/16 in. and above, by the evolution of suitable types which can replace the imported varieties. Recognising that the imports of long staple cotton of 1-3/16 inch and above cannot be immediately stopped, the Committee is concentrating its attention to the replacement of cottons of 1-1/16 in. to 1-1/8 in., the total imports of which in 1954-55 were of the order of 3.8 lakhs bales valued at 28.74 crores.

Three improved extra-long staple cotton strains, viz. M.C.U. 2 of Madras, *Devitej* and *Deviraj* of Bombay, possessing a staple length of 1—1/16 inch have already been evolved and recommended for large-scale commercial cultivation. Sea-Island cotton of " Andrews " variety has been successfully acclimatised in Malabar.

TECHNOLOGICAL LABORATORY, CENTRAL COTTON COMMITTEE

Matunga (Bombay State)

IN 1919, the Indian Cotton Committee made the following recommendations for the appointment of a Cotton Technologist.

(1) He should help the Agricultural Departments to arrive at a correct judgement of the value of any new variety of cotton produced

(2) He should undertake other lines of research relating to cotton, viz. an investigation into the differences between the fibres of American and Indian yarns

(3) He should be able to value different varieties of cotton in such a manner as to bring out clearly the real value of staple and of definite increases in its length.

The Indian Central Cotton Committee, in giving effect to these recommendations, built the Technological Laboratory in 1924 and equipped it with an experimental spinning plant and up-to-date instruments for testing fibres and yarns. Thus, the work of the Laboratory mainly consists in providing the cotton breeders, working in the various experimental stations of the State Departments of Agriculture, with authoritative valuation of the quality of new cottons evolved by them from time to time and thus enabling them to evolve varieties which, when produced on a commercial scale, would prove acceptable to the spinners and also bring a better monetary return to the growers. The Laboratory thus forms an effective link in the chain of agricultural research directed towards the improvement of the cotton crop in India.

The Laboratory undertakes spinning tests, measurement of fibre properties and yarn characteristics of Indian cottons and determines the relationship between the fibre properties and the spinning value of cotton.

To cater to the needs of the cotton trade and mills by providing them with data in regard to the quality of different cottons handled by them, arrangements were made in 1929 for carrying out laboratory tests on representative samples of the principal trade varieties of Indian cotton.

In 1937, testing of samples of cotton sent by individual mills and firms was undertaken in the laboratory on payment of nominal fees. In view of the realisation by the public of the useful work done in the laboratory, a Testing House at the Laboratory was established in the same year. Samples of raw cotton, yarn, piece goods, textile auxiliaries, fibres, etc. are now accepted for various textile tests on payment of nominal fees prescribed by the Committee.

As the main aim of the Laboratory is to help the cotton growing industry in general and as it was felt that the ginning of Indian cottons was far from satisfactory, the Cotton Committee decided to undertake tests and research for the improvement of the ginning of Indian cottons and established a Ginning Section in 1941, equipped with different types of pre-cleaning and ginning machines.

An important phase of the activities of the Laboratory has been the fundamental research on cotton fibre and yarns, standardisation of the various spinning processes, designing of testing apparatus, and devising techniques for the rapid and accurate determination of the fibre and yarn-characteristics of cotton.

A small-sample spinning technique was evolved at the Laboratory by which such small samples as 60 to 100 gm. of lint could be spun. This has enabled the breeder to get a close approximation to the actual spinning performance of a new strain practically during the second year of its propagation. As a time-saving device, this technique has been of great help to the breeders.

Tests on improved varieties

Though care is taken to maintain the purity of a variety under commercial cultivation, it is likely to deteriorate after some time due to genetical and environmental factors. In order to keep a watch on the possible deterioration in quality of an improved variety, tests on samples raised from distributed seeds under various stages of multiplication are made and reported annually.

Mill tests. Since an improved variety has to be accepted by the mills, the laboratory arranges mill tests on every improved variety before it is given out for adoption in general cultivation.

Miscellaneous. Besides the reports on the raw-cotton quality of samples raised in connection with breeding work, several important reports embodying technological data obtained as a result of examination of samples relating to agronomic (manurial, spacing, rotation, etc.) and varietal experiments conducted by the various State Agricultural Departments have been issued to the breeders.

Work for the Cotton Trade and the Industry

Tests on trade varieties. Samples of representative trade varieties in each season are being tested since 1929 and technological circulars embodying the data on each variety are published early in each season for the information of the trade and the industry. At the end of each season these are compiled and published annually as Technological Bulletin.

Testing House. A steady increase has occurred in the number of samples received for tests annually in the Testing House which stood at over 800 samples in 1954-55.

Technological research. This embraces a very wide field from the fibre to the spindle point, and several technological bulletins have been published. A few of the more recent items of work are mentioned below :

Ginning problems :

1. A roller gin of Macarthy type with 7 in. roller length has been designed which can be worked either by hand or power suitable for ginning the produce of a single plant. This has been found most useful to the breeders
2. A ginning percentage balance has been designed and patented. The percentage value can be read on the beam after placing the lint in one pan and the seeds in the other. This balance had proved quite useful to breeding stations where thousands of small samples have to be tested for ginning percentage
3. A standard ginning technique has been evolved and recommended to all breeding stations in India
4. A lint cleaner has been fabricated which can be used to clean the lint after roller ginning.

5. Experiments carried out on the single roller gin after converting the bush-bearings into ball-bearings have recorded a saving of as much as 30 to 40 per cent in power consumption. This has been much appreciated by ginning factories and several of them are resorting to this conversion.

6. Several technological leaflets indicating the cleaning efficiency of the different pre-cleaning machines, the optimum speed and settings in the gins suitable for each variety to yield the maximum output with the least power consumption and good lint quality have been published for the benefit of the ginning factories.

7. An economic and technical survey of the existing gins in India has been undertaken.

8. A short course of training to the literate personnel working in the ginning factories is being given annually. The course includes theoretical and practical aspects of ginning and is designed to bring about improvement of ginning in Indian cottons.

Problems of fibre-characteristics

1. An apparatus of the ballistic tester type for the measurement of the strength of attachment of fibres to cotton seed has been fabricated.

2. A bulletin has been published on the importance of properly estimating the staple length of cotton for the benefit of the cotton trade. It has been recommended that the Indian grader should improve his estimate of staple length in order that the cotton might fetch a proper monetary return to the grower.

3. An X-ray unit has been installed to correlate fibre-strength with X-ray angles of cotton fibres which are obtained from the X-ray diffraction patterns.

Problems of fibre and spinning characteristics

1. An apparatus for the estimation of neps in cotton lint, yarn, etc. has been designed. A procedure for counting neps in raw cotton has been standardised so as to be of use both to the breeders and the spinners.

2. The performance of mixings of Indian Cottons with special reference to their fibre properties is being studied.

Problems of spinning and yarn characteristics

1. Formulæ have been evolved to predict the yarn-strength from one twist-multiplier to another when spun into the same count.

2. Experiments carried out on Indian cotton bales stored in the areas of cultivation and in Bombay godown have shown that there is little change in lint quality even after storage for a period of 2½ years.

3. The Laboratory has carried on investigations on the suitability of long-staple Indian cottons for combing purposes to spin fine counts for which foreign cottons are generally used by the mills. The results indicate that Indian cottons could replace foreign cottons for this purpose.

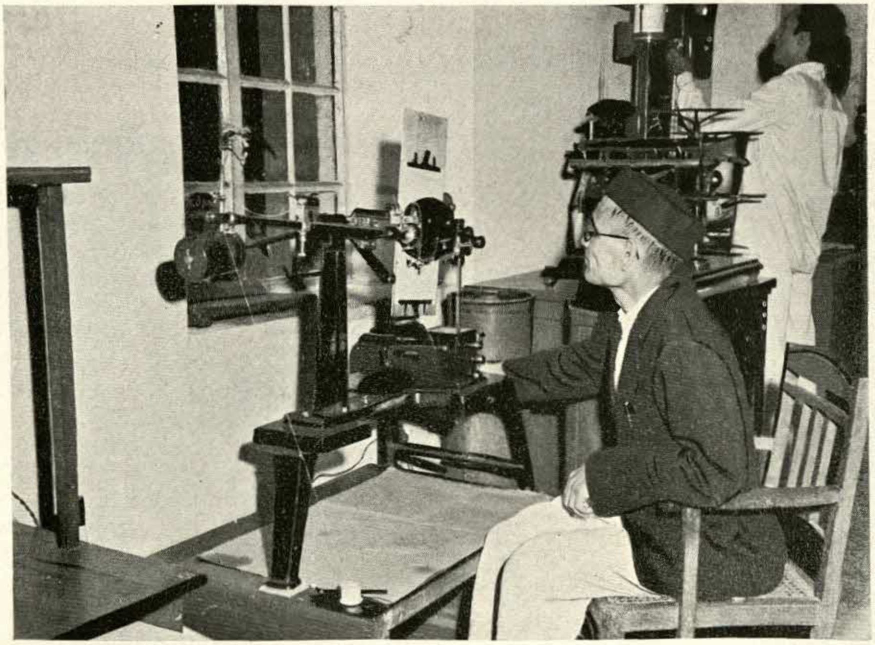
Chemical problems

1. A dyeing technique for determining the maturity count of a cotton without the aid of a microscope was evolved for the use of breeders for rapidly testing a large number of samples.

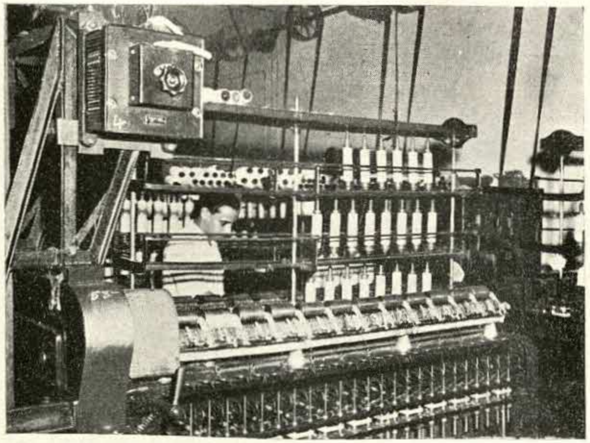
2. Experiments carried out at the Laboratory show that Indian cotton contains only 0·03 to 0·25 per cent of sugar which does not vary from season to season in the same variety.

3. Experiments at the Laboratory have shown that the chemical degradation of cotton fibres at various stages of mechanical processing was not of great consequence in comparison with that produced in subsequent chemical treatments like alkali boil, etc.

4. The linter contents of different varieties of Indian cottons, their quality, etc. were investigated at a factory in Hubli. The results indicate that high grade cellulose can be made from these Indian linters which are quite suitable for several industrial purposes.

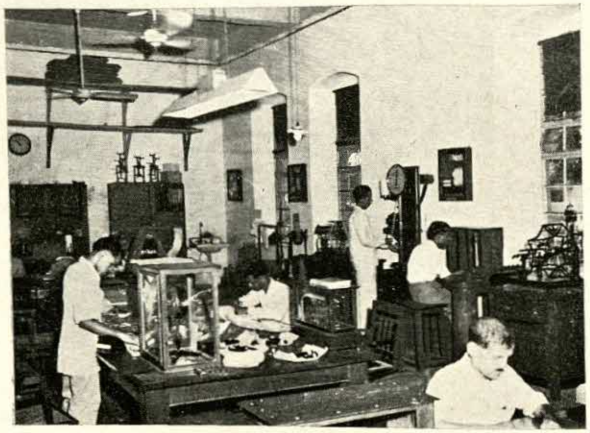


Yarn Testing Section, Technological Laboratory, Central Cotton Committee, Matunga, Bombay

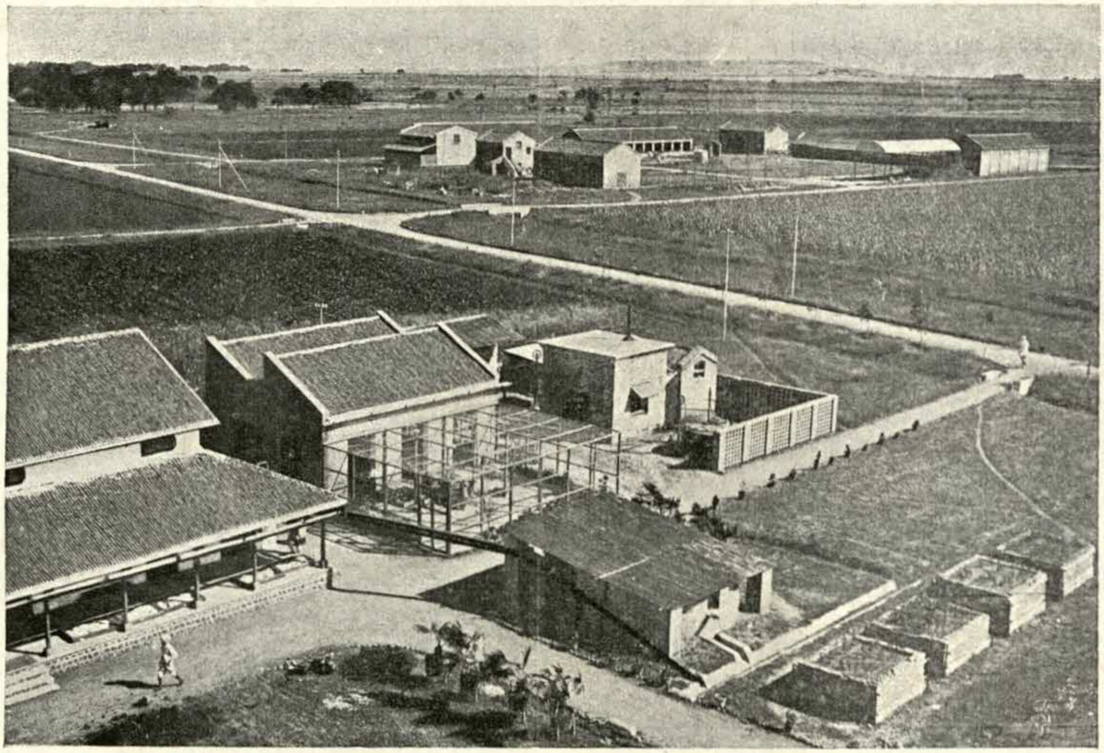


Spinning Section—Ring Frame, Technological Laboratory, Central Cotton Committee, Matunga, Bombay

Yarn Testing Section, Technological Laboratory, Central Cotton Committee, Matunga, Bombay

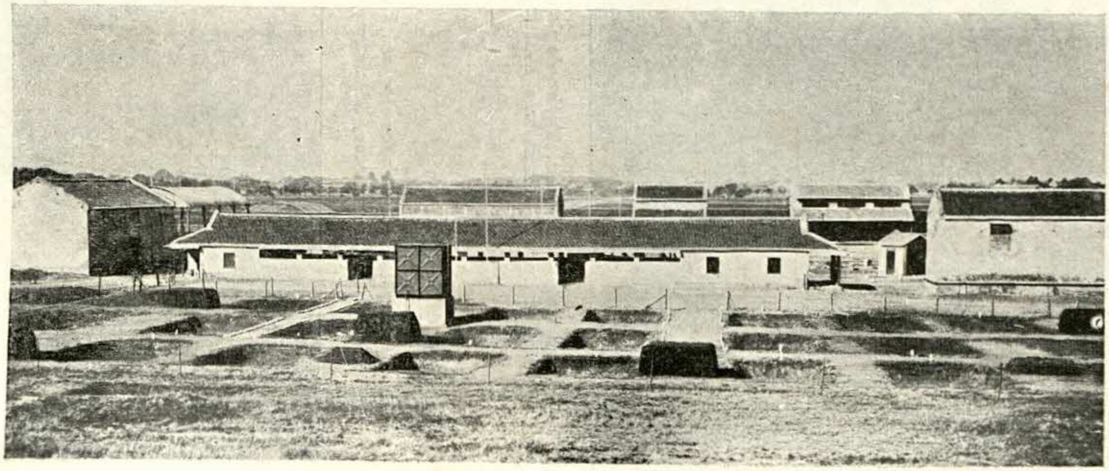


Fibre Testing Section, Technological Laboratory, Central Cotton Committee, Matunga, Bombay



Aerial view of the Institute of Plant Industry, Indore

Compost factory at the Institute of Plant Industry, Indore



INSTITUTE OF PLANT INDUSTRY

Indore (Madhya Pradesh)

THE Institute of Plant Industry at Indore was started in 1924 to cater to the needs of princely States of Central India. As cotton was one of the most important cash crops in this region, this Institute originally started research work on cotton and its rotation crops.

The late Sir Albert Howard, who retired in 1924 as Imperial Economic Botanist from the Central Institute of the Government of India at Pusa was appointed its first Director. Indore being centrally situated and being an important industrial centre for cotton, was selected as the most suitable centre for this Institute. Indore State generously gave 300 acres of land on a nominal rent for this purpose. The Institute is situated at a distance of two miles from the railway station of Indore.

FINANCE AND ORGANISATION

The finances were contributed both by the Central Government through the Indian Central Cotton Committee and the various States which it served. This arrangement is being continued even now. The total cost of about two lakhs of rupees is contributed on 60 : 40 basis by the Central Government through the Indian Central Cotton Committee and the Madhya Pradesh Government.

The management is vested in a Board of Governors and regulated by its Memorandum of Association and Rules. The membership of the Board consists of four nominees of the Central Government, and three of the Madhya Pradesh Government, with the Additional Secretary to the Central Ministry of Agriculture as its President and the Director of the Station as its Secretary.

The laboratories are well equipped for undertaking research in genetics, cytology, plant breeding, statistics and agronomic problems. The library contains 1,500 books on agriculture and allied subjects together with 7,000 volumes of scientific journals.

The farm comprises an area of 300 acres out of which 233 acres are under cultivation and the remaining area is under buildings, roads and grass. The soil represents the typical black cotton soils of the Malwa Plateau which is about 1600-1800 ft. above sea level.

The work is split up into following five sections:

a. Plant Breeding and Genetics
b. Statistics
c. Agronomy
d. Plant Protection
e. Farm

Plant Breeding and Genetics

Breeding work is undertaken chiefly on cottons both *desi* (indigenous) and American types and also on wheat, gram, *juar*, groundnut and linseed.

Cotton. The improvement of *desi* cotton in Malwa was taken up soon after the Institute was established in 1924. As a result, Malwi 9 was evolved in 1932 which was found superior to the existing types in yield of seed, ginning out-turn and fibre qualities. Another strain known as *Bhoj* was developed which was 90 per cent resistant to wilt under field conditions. Breeding work on cotton in Nimar region was started in 1934 and several improved strains were evolved. One of these known as *Maljari* was found to be the best and has been under multiplication since 1953.

The American cotton (*G. hirsutum*) was introduced in Malwa in 1912 and now forms about 60 per cent of the local mixture. As a result of selection, two strains, viz. Indore 1 and Indore 2 have been obtained and the latter is being distributed to the cultivators. Indore 2 has been crossed with long staple cotton from East Africa and America to further improve its fibre properties.

Two high-yielding strains, viz. A.51-9 and A.51-10 were isolated from Nimar region. Of these, A.51-9 is superior to A.51-10 in ginning out-turn and hence it has been distributed to the cultivators. In order to evolve a suitable strain for Rajputana, work was undertaken in Udaipur in 1948 and several superior strains were evolved. Of these M.48-16 was found to be the best.

Another line of work for evolving a long staple American cotton for Malwa was started as early as 1942 and consisted of producing fertile interspecific hybrids. For this purpose, *G. arnprei* was crossed with the African wild species *G. thurberii.* The chromosome number of this hybrid was successfully doubled by colchicine and then it was backcrossed with *G. hirsutum.* As a result of selection from this highly genetically variable material, a few promising strains have been selected, viz. Th 45, Th 128, Th 144 and Th 146. These are now being tested in large field-scale trials.

Wheat. Breeding work on wheats was started in 1934 by making single plant selections, and these were later on compared with the locals (both *durum* and *vulgare*) at the Institute for four seasons (1936-39). Two of the *durum* selections, viz. R. 14, a red grained variety, and EK-69, a white grained variety and N. 24 from the *vulgare* selection were found to be high yielders. Another strain, viz. N. 111, belonging to *T. turgidum* fetched more premium for its quality. From another lot of selections, which was made in 1939, a strain known as F. 16 was evolved which was also found to yield higher than Malvi local. Side by side with the selection work, hybridisation work was also started in order to obtain types resistant to black rust, *Puccinia graminis tritici.*

Promising progenies of crosses between the local *durums* and *vulgare* types and exotic types resistant to rust were transferred to the All India Co-ordinated Wheat Rust Scheme started at Indore in 1952 under the auspices of the Indian Agricultural Research Institute, Delhi.

Breeding work on other crops was also undertaken and the following improved strains of each crop have been evolved:

Jowar (*Andropogon sorghum*)	I.P.I.3 (loose head and chalky grains) I.P.I.9 (compact head and yellow grains)
Tur (*Cajanus indicus*)	I.P. I.5
Groundnut: (*Arachis hypogea*)	AK.12—24 and Ex. 7
Linseed (*Linum usitatissimum*)	I.P.I. 6 (fawn seed coat, corolla white)
Gram (*Cicer arietinum*)	I.P.I. 707 and 22

Statistics

Statistical investigations were started in 1934 to standardise the methods of design and layout of field experiments and determining the optimum plot size, types of designs, etc. for breeding and agronomic experiments. Statistical methods have been developed to study the inheritance of quantitative characters and to determine the genetic component of the total variance by taking the regression of the progenies on the parental values. Discriminant functions for selection in cotton, wheat and maize have been worked out. Crop surveys for estimating yield in cotton and other crops and sampling studies in field experiments are also being carried out by the Section.

AGRONOMY

This section deals with experiments on different crops in relation to manuring, cultural and rotational practices. These include trials on cotton, *jowar*, wheat, etc. and both organic manures and inorganic fertilizers have been applied for supplying different doses of N and P_20_5. Their economics are also being worked out. A twelve year four-course rotational experiment is in progress at the Institute for the last eight years. Weedicides are being used for controlling weeds and improving crop yields.

Plant Protection

Entomology. The cotton pests of Malwa have been studied intensively. Various new synthetic insecticides are being tried against jassids, leaf caterpillar and other insect pests on cotton. Similar trials are being conducted against stemborers and Pyrilla on sugarcane and insect pests on other crops.

Pathology. Work on the evolution of strains of cotton resistant to wilt (*Fusarium vasinfectum*) has been undertaken by growing the plants under infected field and glass house conditions. Rust and wilt resistant strains of linseed received from various States are also tested for assessing their capacity of resistance. Fungicides are being tested against cotton wilt.

Compost Farm

A new method of composting farm refuse known as the 'Indore Method' has been developed. The compost thus prepared contains about 0.9 per cent nitrogen and is ready for use within three months. The Farm Section also deals with the improved methods of cultivation, multiplication of seeds of improved varieties of different crops for distribution to cultivators.

EDUCATION

In addition to research work, the Institute has been giving training in cotton research and improved methods of agriculture to students deputed from neighbouring States. Post-graduate training has also been imparted regularly for M.Sc., and Ph.D. degrees in agriculture, botany and statistics. Two educational schemes have been started recently at the Institute. One is for training of Adivasi (aboriginal tribes), students and the other for training of village level workers in improved methods of agriculture. The services of the staff of the Institute are requisitioned for taking classes under both these schemes, and the students get the added advantage of seeing the research in progress in different Sections of the Institute and also of using the library.

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL COTTON COMMITTEE

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
CURRENT SCHEMES						
Research on cotton	Orissa	7 years (1954-61)	1.82	To develop superior strains of American cotton	Buri 0394, MCU-1 and Parbhani American proved to be high yielding and suitable to the conditions of Orissa	
Survey of cotton areas in Malwa	Indore	2 years (1956-58)	0.29	To isolate a strain of *desi* cotton better than Bhoj or Jarilla in yield		
Improvement of cotton	Rajasthan	10 years (1948-58)	1.82	To evolve a variety of American cotton superior to C. Indore-1 for growing under irrigated conditions and an indigenous improved variety superior to local *desi* cotton for *barani* tracts	Some superior varieties evolved	
Improvement of cotton	Rajasthan	2 years (1956-58)	0.20	To evolve high-yielding varieties possessing better quality		
Improvement of cotton varieties	Bombay	15 years (1942-57)	1.06	To improve Dharwar American cotton grown in Kannada districts of Bombay State and adjoining areas	Laxmi evolved as superior to Gadag-1 in all respects	
Multiplication and distribution of improved cotton seed	Punjab	5 years (1952-57)	0.91	To bring more area in Pepsu under improved American strains	During the year 1955-56, an area of 2.5 lakh acres was covered with 320F and 216F	
Multiplication and distribution of improved cotton seed	Uttar Pradesh	9 years (1952-61)	2.68	To cover an area of 1.5 lakh acres in Uttar Pradesh with 35/1 cotton	During 1955-56, an area of 45,345 acres was covered by 35/1 cotton	
Multiplication and distribution of improved cotton seed	Rajasthan	8 years (1951-59)	1.13	To cover the whole cotton growing area in Mewar with pure C-Indore-1 seed	During the year 1956-57, an area of 1 lakh acres was covered with C-Indore-1	
Multiplication and distribution of improved cotton seed	Madhya Pradesh	3 years (1956-59)	0.58	To cover the entire area of 2 lakh acres in Nimar Zone with D. 48-154 cotton	—	
Multiplication and distribution of improved cotton seed	Madras	5 years (1953-58)	1.04	To cover an area of 2 lakh acres in winter cropped area with M.U.C.-1 cotton	During 1955-56, an area of 1,04,900 acres was covered with M.C.U. 1 cotton	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL COTTON COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Multiplication and distribution of improved cotton seed	Madras	7½ years (1950-58)	3.89	To cover an area of 5 lakh acres with K. 2 cotton and 60,000 acres with M.C.U. 2 cotton	During 1955-56, an area of 2.63 lakh acres was covered with K. 2 cotton and 60,250 acres with M.C.U. 2	
Multiplication and distribution of improved cotton seed	Madras	3 years (1955-58)	0.82	To cover an area of 1.42 lakh acres with K. 5 cotton	During 1955-56, an area of 1.16 lakh acres was covered by K. 5 cotton	
Multiplication and distribution of improved cotton seed	Punjab	4½ years (1953-58)	0.63	To cover an area of 3.80 lakh acres with 320F. American cotton	During 1955-56, an area of 3.49 lakh acres was covered with 320F cotton	
Establishment of seed multiplication farms	Bombay	5 years (1956-61)	0.96	To establish two seed-farms of 200 acres to supply pure seeds of Gaorani-6 cotton	—	
Multiplication and distribution of improved cotton seed	Punjab	2¾ years (1956-59)	0.10	To cover an area of 1.27 lakh acres with H. 14 cotton	—	
Improvement of cotton in South-eastern districts	Punjab	15 years (1945-60)	2.42	Evolving strains of American cotton with longer and finer staple and high-yielding strains of *desi* cotton	H. 14, AC. 79 and AC 53 selected for further tests. Strain 231 Rosea of *desi* cotton proved superior to M. 60-A2 in yield of ginning out-turn	
Study of insect pests of cotton crop and their control	Punjab	4 years (1956-60)	0.47	1. Finding out co-relation between climate and population of different pests 2. Experiments with certain new chemicals regarding insect mortality, phytotoxicity hazard to manual workers and farm animals and economics as regards cost of operation and additions in crop yield	—	
Agronomy of American cotton	Punjab	10 years (1952-62)	3.74	Experiments with different American varieties for higher yield	Strain 320F/35 has proved to be better in yield, ginning out-turn and resistance to jassid attack. Sowing done in the middle of April, gives higher yields; closer spacing of 2½ft. × 1½ft. was found to be optimum for enhancing	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL COTTON COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
					yield. Application of 50 lb. and 100 lb. nitrogen per acre as ammonium sulphate alone and in combination with farmyard manure at flowering stage proved very profitable	
Improvement of long staple American cotton as a winter crop	Madras	10 years (1949-59)	4.50	1. Evolving long staple American cotton suitable for cultivation in early and late winter 2. Selecting a higher yielding and better ginning type than Monteserrat	1. Cultures 9030 and 0734 isolated with cosmopolitan habit and consistent yield performance 2. Variety 'Andrews' found phenomenally high yielding, better in fibre properties than 'Karnak' and adjudged capable of spinning over 60s in small scale tests	
Production of long staple cotton	Madras	(1946-56)	1.71	(*a*) Isolation of longer staple up-land strains capable of maturing in 5½ months and (*b*) evolution of Barbadense varieties suitable for cultivation in coastal belts of South Arcot District	Certain superior selections derived by crossing East African type	
Breeding unirrigated Cambodia cotton	Madras	10 years (1950-60)	1.49	Evolving a hardy and productive type of long staple Cambodia for cultivation as unirrigated crop in Central and Southern Districts	PK. 719 found to give the highest yield of seed cotton possessing also good ginning out-turn and fibre properties	
Improvement of Tinnevelly and Karunganni cottons	Madras	10 years (1948-58)	1.28	Isolating a long-staple strain by synthesis of long staple *desi* cottons capable of cultivation in central and southern districts of Madras State	Strain 6186-9 isolated which promises well for its yield, staple, ginning and spinning characters	
Evolution of an early variety of cotton suitable for cultivation as an off-seasonal crop in rice fallows	Madras	5 years (1954-59)	0.92	Evolving an early maturing variety of cotton which combines long staple and high ginning and at the same time fits in the agricultural time-table of deltaic tracts where paddy is the main crop	Strains P. 216F, H. 14 and P. 23F found superior in yield	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL COTTON COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Improvement of cotton varieties	Bombay	10 years (1951-61)	1.71	To evolve an early variety superior to Kumpta cotton in yield, ginning percentage and quality	Improved strains superior to Jayadhar evolved	
Physiological research on cotton	Bombay	—	1.80	To increase the yield per acre under fine types of cotton	Yields increased by 50 to 90% by advance in date of sowing by about a month	
Breeding American cottons resistant to black-arm	Bombay	8 years (1953-61)	0.50	To breed black-arm resistant cottons	134 Co. 2-M. 21-1 and 21-2 proved highly resistant to black-arm	
Breeding perennial cottons	Bombay	10 years (1950-60)	0.91	Production of perennial hybrids resistant to black-arm and bollworm	Promising material evolved	
Breeding Cambodia cotton	Mysore	15 years (1945-60)	3.94	To evolve long staple American cottons suitable for irrigated *rabi*-crop of Tungabhadra Project area and the rain-fed tracts	M.A. 2 and M.A. 11 found to be promising and Laxmi found outstanding in yield, ginning outturn and staple length	
Breeding long staple American cotton	Mysore	15 years (1944-59)	1.27	(1) Acclimatisation and breeding of Egyptian and Sea-Island cotton (2) Evolving superior strains of upland American cotton resistant to red-leaf disease (3) Evolving short duration cottons for rotation in rice fallows	Several superior strains evolved	
Improvement of Western cotton	Mysore	10 years (1949-59)	2.28	To evolve an early maturing cotton with long staple and superior ginning and spinning qualities having lower waste percentage	Some superior cultures produced	
Improvement of Hill cotton	Assam	11 years (1947-58)	1.09	To produce high-yielding coarse short staple cotton with high ginning percentage	Four promising strains evolved	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL COTTON COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Improvement of cotton	Uttar Pradesh	10 years (1951-61)	1.34	To evolve a superior long staple cotton from *desi* and American varieties suitable for cultivation in western and central U.P.		
Improvement of cotton	Uttar Pradesh	10 years (1951-61)	0.39	To evolve (*i*) a *desi* variety suitable for growing under *barani* conditions in the sub-montane districts and (*ii*) hardy American types which can be grown under irrigation in restricted localities as a rotation crop with sugarcane	Standard variety 35/1 out-yielded the American strains LSS and 320F. Strain also found outstanding in yield	
Khandera cotton breeding	Bombay	13 years (1948-1961)	2.92	Improvement of staple of 197.3 and production of better strains of Jarila	Strain Y-1 evolved	
Mathio Cotton research	Bombay	21 years (1937-58)	1.27	Evolving varieties superior to Mathio	Pratap and C.J. 73 evolved	
Co-ordinated crop-weather investigations	Bombay	11 years (1947-58)	2.39	Studying crop-weather relationship	A number of observatories have been established in various States	
Simple manurial experiments on cultivators' fields	Bombay	4 years (1954-58)	0.81	Studying effect of fertilizers on yield on cultivators' fields	Application of N gave good response at certain places	
Production of hybrid seeds	Bombay		0.08	Production of hybrid seeds	Hybrid seeds produced from BC 68 Sea Island	
Breeding for resistance to wilt	Bombay	22 years (1937-59)	2.00	Production of wilt resistant types, and control of certain diseases	Wilt-resistant strains evolved	
Breeding *desi* cotton	Bombay	5 years (1953-58)	3.89	Evolving strains superior to H. 420 and Jadi	Nos. 13A, B12A and 16 found to be promising	
Breeding of American cotton	Bombay	5 years (1953-58)	1.47	Evolving strains superior to B. 0394 and 0396 and resistant to disease and Jassid	Varieties 0296-7 and 147 found promising and some cultures resistant to black-arm and Jassid discovered	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL COTTON COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Agronomy of long staple American cotton	Shri Shivaji Education Society, Amravati	3 years (1954-57)	0.46	Studying the agronomy of long staple American cotton to maximise *kapas* yield	Spacing of 24 in. × 24 in. premonsoon sowing and application of 60 lb. N found to be remunerative in Buri D 394 and B. 147	
Improvement of cotton in Parbhani district	Bombay	11 years (1947-58)	2.80	Evolving improved strains by selection and hybridisation superior to Daulat	Five strains superior in yield discovered, Nos. 5177 and 5274 being early maturing and No. 5378 being 100% wilt-resistant	
Improvement of cotton in Aurangabad and Bhir districts	Bombay	10 years (1952-62)	1.62	Evolving high yielding improved varieties of *indicum* or *verum* type resistant to wilt	No. 3591 evolved. Three other promising strains under study	
Breeding extra long staple cotton	Punjab	12 years (1949-61)	4.51	Evolving strains possessing a mean fibre length of 1-1/8 inch and above	Out of the six promising strains, Nos. LL53 and LL54 proved to be best in length	
Breeding American cotton suitable for central and sub-montane districts	Punjab	10 years (1948-58)	1.47	Breeding of superior strains combining high-yielding capacity, early maturity and adaptability of 320F	Strains J 2 and J. 34 possessing higher ginning percentage and greater mean fibre length than 320F have outyielded the standard 320F	
Manurial trials	Punjab	6 years (1952-58)	1.47	Obtaining information on manurial requirements of American cotton in relation to other controlling factors	Optimum dose of ammonium sulphate was determined for different areas. Found that (*i*) higher doses of ammonium sulphate not only gave higher yields but had beneficial residual effect on the succeeding crop (*ii*) early sowing and closer spacing were conducive to higher yields and (*iii*) cotton sown after fallow and leguminous crops gave higher yields than after wheat	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL COTTON COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Multiplication and distribution of improved cotton seed	Bombay	6 years (1951-57)	2.19	To cover an area of 10 lakh acres in Khandesh tract with 197/3 cotton	During 1955-56, an area of 9.5 lakh acres was covered with 197/3 cotton	
Multiplication and distribution of improved cotton seed	Bombay	3½ years (1953-57)	0.41	To cover an area of 5 lakh acres in Surat tract with 2087 cotton	During 1955-56 an area of 4.88 lakh acres was covered with 2087 cotton	
Multiplication and distribution of improved cotton seed	Bombay	10 years (1947-57)	3.18	To cover an area of 6 lakh acres in North Gujerat with Kalyan cotton	During 1955-56 an area of 5.5 lakh acres was covered with Kalyan cotton	
Multiplication and distribution of improved cotton seed	Bombay	14 years (1943-57)	2.63	To cover an area of 10.4 lakh acres with Vijay cotton	During 1955-56, an area of 10.3 lakh acres was covered with Vijay cotton	
Multiplication and distribution of improved cotton seed	Bombay	7½ years (1951-59)	2.19	To multiply pure seed of H. 420 cotton in Vidarbha	During 1955-56, an area of 7.28 lakh acres was covered with H.420 cotton	
Multiplication and distribution of improved cotton seed	Bombay	5 years (1953-58)	1.05	To cover an area of 11.49 lakh acres with Buri 0394 cotton in Vidarbha tract	During 1955-56, an area of 1.92 lakh acres was covered with Buri 0394 cotton	
Multiplication and distribution of improved cotton seed	Bombay	5 years (1955-60)	0.75	To cover an area of 1.22 lakh acres in Nagpur-Wardha tract with No. 91 cotton	During 1955-56, an area of 1365 acres was covered with No. 91 cotton	
Multiplication and distribution of improved cotton seed	Bombay	7½ years (1950-58)	1.21	To produce and distribute pure seed of Gaorani-12 cotton in Osmanabad and Bhir districts	During 1955-56, an area of 2.79 lakh acres was covered with Gaorani-12 cotton	
Multiplication and distribution of improved cotton seed	Bombay	4 years (1955-59)	0.66	To cover an area of 5 lakh acres in Parbhani district with 2204 (Daulat) cotton	During 1955-56, an area of 3,800 acres was covered with 2204 (Daulat) cotton	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL COTTON COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Multiplication and distribution of improved cotton seed	Bombay	8 years (1953-61)	0.98	To cover an area of 2 lakh acres in Saurashtra region with Pratap cotton	During 1955-56, an area of 8,000 acres was covered with Pratap cotton	
Multiplication and distribution of improved cotton seed	Bombay	7 years (1954-61)	2.28	To cover an area of 9 lakh acres in Saurashtra region with Kalyan cotton	During 1955-56, an area of 90,000 acres was covered with Kalyan cotton	
Multiplication and distribution of improved cotton seed	Bombay	2 years (1956-58)	0.20	To cover an area of 1.03 lakh acres in Saurashtra region with Indore American cotton (170-Co. 2)	—	
Establishment of Institute of Plant Industry, Indore	Madhya Pradesh	1924 onwards	32.20	Fundamental genetical work relating to cotton and improvement of cotton and its rotational crops	A good deal of useful work has been done	
Improvement of Nimar cotton	Madhya Pradesh	10 years (1948-58)	1.77	To evolve superior strains of *desi* cotton and American cotton	Several promising strains evolved	
Long staple American cotton breeding	Madhya Pradesh	5 years (1954-59)	0.82	To evolve superior long staple American cottons		
Improvement of White Northern cotton	Andhra Pradesh	10 years (1949-59)	1.89	To evolve superior types	Some promising strains obtained	
Evolution of white linted cotton	Andhra Pradesh	5 years (1955-60)	0.91	To evolve superior varieties suitable for growing as mixed crop with other crops and also as a pure crop		

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL COTTON COMMITTEE—*(Contd.)*

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
			(COMPLETED SCHEMES)			
Survey of cotton area	Assam	2 years (1952-54)	0.13	To conduct an extensive botanical survey of the cotton growing areas and to collect breeding material for selection		
olgiocal Research Scheme	Sind	11 years (1927-37)	2.74	To investigate problems connected with water requirements and general physiology of the cotton plant under canal colony conditions	March 15th to May 15th was the optimum sowing period for cotton under irrigation. Water requirements were highest during the flowering and fruiting periods. Response to 200 lb. of ammonium sulphate addition to the basal application of compost (15 cart loads per acre) has been found to be the best	
Jassid investigation	Sind	5½ years (1938-43)	0.11	Study of the habits of jassid and its prevention	Hairy types were found to be more resistant to jassids. Sowings after April-May encouraged jassid attack. Results of no practical value could be got	
Black headed cricket	Sind	3 years (1938-41)	0.14	To study its life history and extent of damage caused	Scheme merged with the Baluchistan scheme on this subject	
Cotton breeding investigations	Sind	10 years (1940-50)	0.21	To evolve better varieties of cotton	Six long stapled strains were evolved of which 41/4 and 45/2 ultimately gave satisfactory yields	
Black headed cricket (Sind Baluchistan)	Sind	4 years (1941-45)	0.40	To study the life cycle and investigate control measures	Early sowing of cotton enabled the crop to lodge the insect. 1 Part Sodium Flugsbitch, 1 part molasses, 20 parts rice or wheat bran and 12½ parts water was found to be effective poison bait	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL COTTON COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Periods	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Boll-worm investigation and clean-up campaign	Sind	6½ years (1940-47)	0.86	To study the host plants and to test efficacy of different implements	Destruction of all alternate host plants was an effective remedy. Punjab Kudali was the most suitable implement for uprooting cotton. Clean-up campaigns yielded 21 to 25.6% higher yield quality of cotton was also superior	
Investigation of stability of nitrogenous fertilizers in Indian soils with special reference to their availability for cotton	Mysore, Indian Institute of Science	6 years (1949-55)	0.39	Investigations on loss of nitrogen by volatilisation of ammonia resulting from the decomposition of nitrogenous fertilizers in cotton soils		
American cotton research	Mysore, Indian Institute of Science	9 years (1935-44)	0.69	To breed suitable types resistant to "Red leaf" disease	Varieties like Co. 2, M.A. II and N.T. 38 or 38 F were more resistant to "Red leaf" disease than others and selections made from M.A. II showed a greater degree of resistance to disease than those of Col. 2 199F was proved to be the outstanding American variety	
Cotton improvement Scheme (Gang Canal cotton)	Bikaner	13 years (1930-44)	0.70	To evolve superior varieties of cotton		
Cotton genetics research	Institute of Plant Industry, Indore	6 years (1940-46)	2.53	Genetical and statistical investigations	Several useful results achieved.	
Cotton physiological research	Madhya Bharat	—	—	Study of the interrelationship between the soil and climatic factors and the growth of different varieties of cotton	Application of 10 to 12 parts per million of napthalene, acetic acid spray increased the yield by about 50% in the case of *desi* cotton	
Root rot Scheme	Baroda	10 years (1932-43)	0.92	Study of root rot and securing root rot resistant strains	No positive results were obtained	
Improvement of Mathio cotton	Baroda	15 years (1937-52)	0.91	To improve Mathio mixture		
Plant Puller propaganda	Baroda	6 years (1936-42)	0.33	Eradication of spotted bollworms by uprooting stalks		
Survey of Goghar cotton	Baroda	5 years (1935-40)	0.05	To eliminate the short stapled Goghar	Successful results achieved	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL COTTON COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Distribution and extension of improved cotton	Bombay	6 years (1930-36)	0.44	Extension of Jayawant cotton	1,43,800 acres were covered with Jayawant in Hubli area	
Distribution and extension of improved cotton	Bombay	5 years (1930-35)	0.62	Extension of Gadag-1 cotton	83,693 acres were covered with this cotton in Gadag area	
Distribution and extension of improved cotton	Bombay	15 years (1930-45)	0.94	Extension of 1027A.L.F. cotton	More area brought under 1027 A.L.F. in Surat tract in 1934-35, it was as large as 1.93 lakh acres	
Distribution and extension of improved cotton	Bombay	6 years (1931-37)	1.66	Extension of Banilla cotton	66,000 acres brought under Banilla in Jalgaon area. Gain to cultivators during 6 years estimated at Rs. 4.5 lakhs	
Distribution and extension of improved cotton	Bombay	5 years (1932-37)	0.18	Extension of Jayawant cotton	31,028 acres covered with Jayawant cotton in Athani taluka	
Distribution and extension of improved cotton	Bombay	8 years (1934-42)	0.03	Extension of Banilla cotton	6,000 acres brought under Banilla in Deccan Canal (Kopargaon) area	
Distribution and extension of improved cotton	Bombay	14 years (1936-50)	2.43	Extension of Jayawant and Gadag No. 1 cotton	5.05 lakh acres brought under Jayawant and 1.52 lakh acres under Gadag No. 1 in Hubli, Athani, Bagalkot and Bijapur areas	
Distribution and extension of improved cotton	Bombay	8 years (1935-43)	0.41	Extension of B. D. 8 cotton	27,339 acres brought under B.D. 8 in Broach area	
Distribution and extension of improved cotton	Bombay	14 years (1937-51)	2.64	Extension of Jarila cotton	1.9 lakh acres brought under Jarila in Khandesh	
Maintenance of nucleus of pure seed of improved varieties of cotton	Bombay	4 years (1938-42)	0.10	Maintenance of nucleus of improved cotton varieties	The selfed seeds for 1027 A.L.F. B.D. 8, Jarila, Banilla, Jayawant and Gadag No. 1 were obtained	
Maintenance of nucleus of pure seed of improved varieties of cotton	Bombay	11 years (1942-53)	0.10	Extension of 1027 A.L.F. cotton	19,800 acres brought under 1027 A.L F. in Nawapur taluka	
Maintenance of nucleus of pure seed of improved varieties of cotton	Bombay	4 years (1943-47)	0.26	Extension of 'Wagotar' cotton	13,652 acres brought under Wagotar in Wagad tract	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL COTTON COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Maintenance of nucleus of pure seed of improved varieties of cotton	Bombay	8 years (1945-53)	0.73	Extension of Suyog cotton	4.91 lakh acres brought under Suyog in Surat tract	
Maintenance of nucleus of pure seed of improved varieties of cotton	Bombay	7 years (1950-57)	1.61	Extension of Jayadhar and Laxmi cotton	During 1955-56, 6.07 lakh acres were brought under Jayadhar and 5.38 lakh acres under Laxmi in Karnatak area	
Maintenance of nucleus of pure seed of improved varieties of cotton	Bombay	5 years (1947-52)	0.61	Extension of improved Kalyan (K-72-2) cotton	2.81 lakh acres were brought under Kalyan cotton in Ahmedabad and Mehsana districts	
Control of Selection 1 A cotton	Bombay	5 years (1940-45)	0.05	To continue cultivation of Selection 1 A in Olpad Taluka and replace it by 1027 A.L.F. in the rest of Surat area	Check Stations were maintained at Tapti and Kim rivers to prevent illicit import of cotton from Olpad to Surat area	
Grading and marking of 1027 A.L.F. and Suyog cottons	Bombay	10 years (1940-50)	0.40	To guarantee the purity of 1027 ALF and Suyog under the Agricultural Produce Act	3225 acres under 1027 A.L.F and 46,001 acres under Suyog were certified during 1949-50	
Distribution and extension of improved cotton	Madras	2 years (1931-33)	0.24	Extention of Cambodia cotton	5117 acres brought under Co2 in Coimbatore District. Gain to cultivators during four years was Rs. 70,84,900/-	
Distribution and extension of improved cotton	Madras	4 years (1933-37)	0.41	Extension of pure Co. 2 cotton		
Distribution and extension of improved cotton	Madras	5 years (1933-35) and (1942-45)	0.41	Extension of H. 1 cotton	Scheme has been suspended during 1935 due to lack of local co-operation in supply of seed	
Distribution and extension of improved cotton	Madras	4 years (1942-46)	0.56	Extension of Co. 3 cotton	31,000 acres covered by Co. 3 in Salem District. The growers got an extra gross income of Rs. 8.3 lakhs during 1945-46	
Distribution and extension of improved cotton	Madras	2 years (1945-47)	0.09	Extension of K. 1 cotton	During 1946-47, 15,200 acres covered by K. 1 cotton in Ramnad and Tinnevelly districts. Scheme closed due to progressive deterioration of K. 1 cotton	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL COTTON COMMITTEE

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Distribution and extension of improved cotton	Madras	3 years (1946-49)	0.36	Extension of C. 11.2 cotton	21,066 acres covered by C. 11.2 cotton in Coimbatore District	
Distribution and extension of improved cotton	Madras	3 years (1948-51)	0.11	Extension of Co. 4 cotton	44,000 acres covered by Co. 4/B40 (MCU. 1). About 30,000 bales of Co. 4/B40 were marketed during 1950-51	
Distribution and extension of improved cotton	Madras	6 years (1948-54)	0.06	Extension of improved type G. 1 cotton	13,334 acres covered by G. 1 (renamed as C. 1) cotton in Guntur District	
Distribution and extension of improved cotton	Madras	3 years (1950-53)	0.07	Extension of Westerns-1 cotton	39,920 acres brought under Westerns. 1 cotton. During 1952-53, 4,574 bags of seeds were produced	
Maintenance of pure seed of improved cottons	Madras	15 years (1938-53)	0.17	To maintain nucleus of Co. 2 H. 1 and K. 1 cotton seeds	Nucleus of the different varieties were maintained	
Marketing of cotton	Madras	(1950)	0.03	Collection of information on marketing of cotton	Survey completed in October, 1950	
Distribution and extension of improved cotton	Uttar Pradesh	3 years (1935-38)	0.19	Extension of C. 402 cotton	1898 acres were brought under C. 402. Scheme closed as extension of area under C. 402 was not possible	
Distribution, extension and Marketing of improved cotton	Uttar Pradesh	4 years (1942-46)	0.81	Extension and marketing of Perso-American cotton	21,710 acres were brought under Perso-American cotton. Gross extra income to growers amounted to Rs. 3.09 lakhs in 1945-46	
Distribution and extension of improved cotton	Punjab	5 years (1948-53)	0.70	Extension of L.S.S. cotton	1.77 lakh acres were covered by L.S.S. cotton in Ferozepur District	
Distribution and extension of improved cotton	Punjab	5 years (1950-55)	0.47	Extension of 216F American cotton	1.34 lakh acres were covered by 216F cotton in Hariana tract	
Marketing of cotton	Punjab	1½ years (1938-40)	0.07	Establishment of regulated markets	Requisite information regarding practices, stocks, etc. of cotton was collected	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL COTTON COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Distribution and extension of improved cotton	Central Provinces	15 years (1930-45)	3.64	Extension of Verum 434 cotton	3,77,934 acres were brought under V. 434	
Distribution and extension of improved cotton	Central Provinces	5 years (1939-44)	0.24	Extension of Buri 107 cotton	45,000 acres were brought under Buri 107 in Burhanpur area. Cultivators got gross extra income to the tune of Rs. 2.8 lakhs	
Distribution and extension of improved cotton	Central Provinces	11 years (1944-55)	0.51	Extension of Jarila cotton	199,090 acres were brought under Jarila cotton in Buldana District	
Distribution and extension of improved cotton	Central Provinces	2 years (1948-50)		Extension of Buri and Cambodia cottons	173,827 acres were brought under Buri and Cambodia cottons	
Distribution and extension of improved cotton	Central Provinces	2 years (1955-57)	0.02	Extension of M. 5. A (Malini) cotton	19,175 acres were brought under M.5.A. (Malini) cotton in Buldana District	
Maintenance of nucleus of pure seed of improved strains of cotton	Central Provinces	3 years (1939-42)	0.03	To maintain nucleus of pure seed of strains V. 434, Late Verum, No. 438 and Buri. 107	Nucleus of strains V. 434 late Verum, No. 438 and Buri 107 were maintained	
Distribution and extension of improved cotton	Mysore	5 years (1946-51)	0.02	Extension of Sel. 69 in black soil and M.A.V. in red soil area	9667 acres were brought under Sel. 69 and 18,218 acres under M.A.V.	
Distribution and extension of improved cotton	Baroda	11 years (1934-45)	0.38	Extension of 1027 A.L.F. cotton	1,60,000 acres were brought under 1027 A.L.F.	
Distribution and extension of improved cotton	Baroda	5 years (1939-44)	0.18	Extension of B.D. 8 cotton	1,09,993 acres were brought under B.D. 8 cotton. During 1943-44 the growers realised an additional income of 12.33 lakhs	
Distribution and extension of improved cotton	Baroda	5 years (1942-47)	0.20	Extension of B. 9 cotton	As the entire Baroda District had been put under 'Vijay' cotton during 1947, the scheme was stopped	
Distribution and extension of improved cotton	Baroda	2 years (1943-45)	0.10	Extension of 'Wagad' 8 cotton	43,247 acres were brought un der wagad cotton in Mehsana District	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL COTTON COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amoung of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Distribution and extension of improved cotton	Baroda	5 years (1945-50)	0.71	Extension of Suyog cotton	1,33,365 acres were brought under Suyog cotton in Navsari District	
Distribution and extension of improved cotton	Baroda	2½ years (1946-48)	0.16	Extension of Wagotar cotton	40,400 acres were brought under Wagotar cotton in Mehsana District	
Distribution and extension of improved cotton	Baroda	8 years (1944-52)	2.55	Extension of Vijay cotton	3.8 lakh of acres were brought under Vijay cotton in Broach District	
Distribution and extension of improved cotton	Baroda	3 years (1949-52)	0.12	Extension of Kalyan cotton	2.8 lakh acres were brought under Kalyan cotton in Mehsana District	
Marketing of cotton	Baroda	8 years (1938-46)	0.21	Organise marketing of 1027 A.L.F. cotton	Steps were aken to help growers of 1027 A.L.F. cotton to realise better prices for their produce	
Distribution and extension of improved cotton	Hyderabad	10 years (1930-40)	0.51	Extension of Gadag I Dharwar I cottons	Distribution of Dharwar-1 was discontinued from 3rd year in favour of Jayawat-1 72,499 acres were brought under Jayawant-1 cotton and 20 acres under Gadag-1 in Raichur and Gulbarga District	
Distribution and extension of improved cotton	Hyderabad	4 years (1950-54)	0.07	Extension of Parbhani American cotton.	1,00,200 acres were brought under Parbhani American cotton in Adilabad district	
Subsidising purchase of improved cotton	Hyderabad	1 year (1949-50)	0.11	To purchase and distribute seed of Parbhani American Cotton	Pure seeds of Parbhani American cotton sufficient for 25,276 acres were distributed	
Distribution and extension of improved cotton	Sind	16 years (1931-47)	4.37	Extension of improved M.4 and Sind Sudhar cottons	6.5 lakh acres were brought under Sind Sudhar, M.4 and N.12 cottons in Barrage area	
Maintenance of nucleus of pure seed of improved varieties of cotton	Sind	4 years (1938-42)	0.10	Maintenance of nucleus of improved cotton varieties	Nucleus seeds were maintained	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL COTTON COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Financing seed distribution	Sind	4 years (1942-46)	1.38	To establish a camp black of long staple cotton in Barrage areas	1250 mds. of seeds were distributed.	Scheme amalgamated with seed distribution and extension schemes
Distribution and extension of improved cotton	Madhya Bharat	1 year (1948-49)	..	Extension of pure American (Buri) cotton	26,000 acres were brought under American (Buri) cotton in Nimar tract.	
Compilation of manurial trials			0.01		Bulletin entitled "cotton manuring in India" by Shri V. G. Panse was published	
Compilation of hand book dealing with pests and diseases of cotton			0.03		Bulletins entitled Insect pests of cotton in India by Nagpal. Disease of cotton in India by B. N. Uppal. published	
Survey of nutritional values in relation to milch buffaloes of fuzzy cotton seed and cotton seed cakes			0.07		Report to be printed as an article in one of the Scientific Journals	
Collection of Iran cotton			0.03		Article published in the Indian Journal of Agricultural Science	
Prize competitions among cotton growers			0.05		Prizes were awarded to the growers who topped the yields in the competition	
Estimation of effects on cotton crop of the use of plant puller			0.04			
Comparative tests at Baroda			0.04			
Breeding Sea Island cottons in Coconut gardens			0.01			
Saurashtra Nawanagar preliminary Scheme			0.01			

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL COTTON COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Physiological research (Surat)	Bombay	10 years (1923-33)	2.91	To ascertain causes of shedding buds, flowers, and bolls and to devise remedial measures	Inadequacy of Nitrogen causes boll shedding. Early application of N increases vegetative growth and retention of buds. Late application causes larger proportion of flowers to ripen into bolls	
Entomological research (Surat)	Bombay	8 years (1923-31)	1.14	To study life history of Spotted Bollworm and devise control measures	Creating of an off-season and discouragement of growing summer *bhendi* were recommended to control the incidence of the pest	
Bollworm propaganda (Surat)	Bombay	4 years (1931-35)	1.29	Intensive clean-up after harvest of cotton and eradication of alternate host plants	The clean-up compaign resulted in an increase of yield from 25 to 30 per cent	
Wilt research, (Dharwar)	Bombay	9 years (1923-32)	2.64	Finding out the cause and remedy of the wilt disease	Wilt was established to be caused by soil fungus *Fusarium vasinfectus* and breeding resistant types was found to be the best means of controlling the disease. Resistant varieties were developed in Jayawant, Vijay, Suyog, Jarila, etc.	
Cotton breeding (Khandesh)	Bombay	5 years (1926-31)	0.28	To test the hybrid derivative Banilla		
Cotton breeding (Jalgaon)	Bombay	16 years (1932-48)	0.41	To evolve a high yielding, high ginning wilt-resistant good spinning cotton	197-3, known as Virnar was evolved	
Cotton breeding (Broach)	Bombay	23 years (1932-55)	0.65	To obtain better cotton than Vijaya in respect of field, ginning, spinning and wilt-resis tance	Strain 98-41, known as big Vijay, proved to be more remunerative than Vijaya and leased for general cultivation	
Small Leaf disease survey	Bombay	1 year (1923-24)	0.05	To survey the intensity of incidence of the disease	Cause of the disease could not be known	
Survey of Goghari cotton	Bombay	2 years (1935-37)	0.05	To examine the possibilities of establishing superior type (1027A.L.F.) of cotton	The survey having proved a success, the Government of Bombay passed legislative measures prohibiting the growing of Goghari	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL COTTON COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Defibration of cotton seed	Bombay	3 years (1936-39)	0.09	To ascertain advantages of defibrated seed	There were no distinct advantages as regards germination of seed, or superiority of oil tests over undefiberated seed	
Plant puller propaganda (Surat, Broach and Panch Mahals)	Bombay	7 years (1934-41)	0.43	To demonstrate the advantages of uprooting cotton stalks and stubbles against Spotted and Pink Bollworm	Ten thousand plant pullers were sold. The cultivators have become clean-up minded	
Breeding of wilt resistant cottons (Surat)	Bombay	18 years (1937-55)	0.63	To obtain a strain completely resistant to wilt	A highly wilt-resistant strain, viz., 2087 'Vijalpa' has been released for general cultivation	
Extension of improvement in cultivation (Surat)	Bombay	5 years (1941-46)	0.14	To demonstrate to the cultivators all the available improvements	The cultivators realised a profit of Rs. 41-1-9 per acre during 1945-46.	
Dry farming research, (Bijapur)	Bombay	4 years (1937-41)	0.08	To grow medium and long staple cottons in tracts of precarious rainfall	Large scale field trials indicated possibility of high yields	
Improvement of cotton (Kira District)	Bombay	5 years (1931-36)	0.15	To find a superior type to replace the *rozi* cotton	No tangible results were obtained	
Interspecific hybridisation in cottons (Surat)	Bombay	19 years (1938-57)	2.68	To obtain fully fertile hybrids between Asiatic and American cottons containing useful agronomic characters of both	Two promising Indo-American strains viz., 170-Co. 2 (Devraj) 1.1/16″ to 1.1/8″ and 134-Co 2-M (Devitej) 1.3/16″ evolved	
Improvement of cotton (Viramgam, Bavla and Vijapur)	Bombay	19 years (1937-56)	1.58	Improvement of Wagad cottons	Improved variety Kalyan (K. 72-2) evolved	
Preliminary study of perennial cottons grown on cultivable waste lands and hill slopes nearBombay	Chandivili (near Bombay)	2 years (1950-52)	0.84	To undertake trials of perennial cottons as well as *hirsutums* to utilise cultivable waste lands	Some *Hirsutum* types like Cokes, Deltapine and perennials and *Barbadense* types were found to be worth attempting on hill slopes	
Agronomy of long staple cotton (Anand)	Chandivili (near Bombay)	4 years (1951-55)	0.65	Studying agronomic features of long staple American varieties	Pre-monsoon sowings proved advantageous. Spacing of 5′X2′ was found to be the best and 170-Co. 2 excelled 134-Co. 2 M. in yield though it was slightly inferior in quality.	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL COTTON COMMITTEE (*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Herbaceum cotton research	Madras	15 years (1923-38)	1.42	Isolation and testing of "Herbaceum" constituents of local cottons	29 strains possessing fineness and lint length equal to *Karunganni* were isolated, seven strains even excelled the standard *Karunganui* strains K.I. in yield	
Physiological research	Madras	12 years (1931-43)	2.01	To investigate methods of control of the Cotton Stem Weevil	4 resistant strains viz., XI02-2-4, X 108-4-1, X82-1-5 and 1-37-1-2, with lower mortality and higher yields than the standard strain Co. 2 were evolved.	
Study of the harmful after-effects of fodder "Cholam" on cotton	Madras	6 years (1931-37)	0.20	To ascertain the causes of harmful after-effects of Cholam (*jowar*) and Cambu (*bajra*) on the succeeding crop of cotton and to suggest remedical measures	It was found that thick sowing of cotton, allowing the soil to crack in summer, ploughing it late and application of correctives like gypsum and molasses removed the harmful after-effects associated with Gholam cropping	
Nadam cotton breeding	Madras	8 years (1933-41)	0.18	To select suitable annual types of cotton to replace the perennial Nadam Cotton	No successful results were achieved	
Improvement of Mungari cotton	Madras	18 years (1938-45)	1.23	Evolution of superior strains suited to the red soils	Improved strains 881F was evolved. C.6-14A2 was found to be superior in lint yield	
Improved of Cocandas cotton	Madras	13 years (1940-53)	1.49	To improve the yield and ginning percentage of cocandas cotton	Strain 336-B or Cocanadas-2 which was superior to Concandas-1 in all the attributes was evolved	
Control of cotton stem weevil	Madras	2 years (1938-39)	0.06	To investigate the possibilities of control of cotton stem weevil by means of its natural enemies		

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL COTTON COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Comilla cotton research	Bengal	8 years (1934-42)	0.44	Improvement of the commercial grades of *Cernuum* cotton	Seven improved high ginning strains were isolated, strains 9(1) being the best	
Cultivation of long staple cotton	Bengal	7½ years (1938-45)	0.14	To test the possibilities of introducing long staple cottons in the well-drained high-land soils	High land areas of the districts of Midnapore, Bankura, Nadia, Jessore Murshidabad and Rangpur were found to be suitable for cultivation of long staple cotton and varieties Parbhani, Co3 and Co4 were found to be promising	
Burma Cotton Improvement Scheme	Burma	6 years (1931-37)	0.48	To increase cotton yield by demonstration of improved methods		
Defibrating and delinting plant	Punjab	2 years (1936-38)	0.06	To find out the economics of the working of defibrating and delinting machines	The results did not prove of any economic value	
Pink and Spotted Boll-Worm Scheme	Punjab	4 years (1934-38)	—	Study on Pink boll-worm and investigation of the economic aspects of the Spotted Boll-Worm	It was found that spread of attack of these pests could be prevented by destroying wild seeds and cleaning up of stumps from cotton fields	
Clean-up Scheme	Punjab	3 years (1937-40)	0.06	To deprive the Spotted Boll Worm of its food during January-April and to study the effect of this measure on the yield of *kapas*	The clean-up measure reduced the population of the spotted boll-worm considerably and the cotton yields increased by 20% in both *desi* and American varieties	
Entomological research	Punjab	12 years (1926-38)	2.26	To ascertain the reason for difference in the incidence of the Pink Boll-worm between South-Eastern Punjab	The severity of incidence of the pest was due to climatic conditions	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL COTTON COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Spraying trials	Punjab	3 years (1933-36)	0.10	To ascertain the most suitable and economic insecticide and proper time for spraying or dusting	Rosin soap and rosin compound solutions were found to be effective in controlling the pests	
Improvement of American 289F cotton	Punjab	5 years (1938-43)	0.21	To improve the Punjab American cotton 289F/125	Some selections were released for cultivation	
Improvement of cotton	Punjab	5 years (1945-50)	0.13	To produce long staple American cotton over a compact block	Two promising strains, 244F and 268F were evolved	
Improvement of cotton in South-Western Tract	Punjab	5 years (1945-50)	0.11	To produce long linted types of American cotton by selection from the local bulk by crossing with exotic long linted upland varieties	Three strains of proved superiority over other varieties of the tract were evolved.	
Improvement of cotton in Lower Bari Doab Canal Colony	Punjab	5 years (1945-50)	0.14	To evolve pure, and breed jassid-resistant and high ginning types	Several improved strains evolved	
Survey of disease of malformation in Punjab American cottons	Punjab	1 year (1934-35)	0.02	To conduct a survey of the disease		
Pink Bolloworm scheme	Uttar Pradesh	8 years (1923-31)	1.47	To conduct investigations on life history and devise measures of control	Heating the seed to 60 was found to be sufficient to kill the hybernating larva but did not affect the the viability of the seed.	
Rohilkhand and Bundelkhand Survey	Uttar Pradesh	4 years (1933-37)	0.18	Survey of the Bengal types to cotton grown in the different cotton tratcts		
Extension of improvements in cultivation of crops	Uttar Pradesh	5 years (1942-47)	0.03	To assist the farmers to secure the highest possible financial return and to build up the fertility of their holdings	The average extra net income obtained per acre by the cultivators was between Rs. 32 and Rs. 56	
Botanical research	Uttar Pradesh	6 years (1938-44)	0.93	To develop improved strains of Bengal & U.P. cottons	Perso-American cotton was isolated and some high yielding strains evolved	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL COTTON COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Hybridisation in arboreum cottons	Uttar Pradesh	6 years (1944-50)	0.23	To evolve improved strains of *desi* cotton	Promising selections were obtained	
Cotton research, Vivekananda Laboratory, Almora	Uttar Pradesh	2 years (1952-54)	0.04	To acclimatise long staple variety for growing at high altitudes and to evolve early maturing annual and perennial varieties	The results showed that long staple cottons would be successful in this region	
Botanical research	Central Provinces	16 years (1923-39)	4.93	To produce superior types of cotton	Strain V.434 which is all round superior was evolved	
Entomological research	Central Provinces	3 years (1934-37)	0.12	Investigations on bollworm	Systematic collection and destruction of dried parts of plants that happen to fall on the ground gave satisfactory results	
Investigation of *Heliothis Obsoleta*	Central Provinces	1 year (1938-40)	0·02	To undertake studies on *Heliothis obsoleta*	It was found that *Heliothis obsoleta* is not a serious pest of cotton	
Cotton breeding	Central Provinces	9 years (1939-48)	1.00	To ascertain the causes of low yield of cotton and to evolve a wilt-resistant high-yideling and superior quality cotton	H. 420 and Buri .0382 were evolved	
Extension of improvements in cultivation of crops	Central Provinces	4 years (1943-47)	0.04	To make improvement in agricultural practices		
Cotton wilt research	Central Provinces	5 years (1923-28)	—	To study the physiological aspects of the wilted condition of cotton plants	It was confirmed that the wilted condition of cotton plants was not pathogenic but physiological and was not likely to lead to anything of practical value	
Improvement of cotton (Akola and Arravati District)	Central Provinces	5 years (1948-53)	0.78	To evolve late ripening strains of improved *desi* cotton	Strain No. .0394 combining all the desirable characters was evolved.	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL COTTON COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Improvement of cotton (Nagpur-Wardha District)	Central Provinces	5 years (1948-53)	1.24	To evolve late ripening strains of improved *desi* cotton	Superiority of No. 111 in yield was established and a strain Buri 0394 was evolved.	
Improvement of cotton (Buldana tract)	Central Provinces	5 years (1948-53)	0.63	To evolve superior strains	Strain 197-3 outyielded all the other promising strains and was found to possess very good fibre qualities and staple besides being sturdier than Jarila	
Improvement of cotton (Ghat tract)	Central Provinces	5 years (1948-53)	0.68	do.	Strain 91 and Buri 0394 given the best performance	
Botanical research	Punjab	20 years (1925-45)	0.68	Improvement of *desi* and American cotton	American strains 289F, L.S., S.289F/43, 199 and 124 F and of improved *desi* strains 119 Sanjuimeum, Mollisoni 258, M.60.A2, were evolved.	
Jassid investigation	Punjab	8 years (1937-45)	0.22	To study the insect and characters of the plant which showed resistance to the pest	The work under the scheme indicated that the evolution of resistant strains was the onlymeans of controlling the pest	
Physiological research	Punjab	9 years (1935-44)	4.09	To investigate the causes of periodic failures of American cotton in the Canal Colonies of the Punjab	Causes and remedial measures of 'tirak' were found	
Root-rot research	Punjab	10 years (1932-42)	0.71	To investigate the cause and control of root-rot	It was found that sowing cotton mixed with *moth* (*Phaseolus aconitifolius*) controlled the disease to a large extent	
White Fly Scheme	Punjab	5 years (1931-36)	0.49	To study the life-history of the white fly (*Bemesio gossypiperda*)	Of the insecticides tried, rosin compounds proved to be the best	

INDIAN CENTRAL JUTE COMMITTEE

Headquarters—Calcutta (West Bengal)

THE Royal Commission on Agriculture recommended the formation of a Central Jute Committee on the lines of the Indian Central Cotton Committee, which would deal with all problems relating to jute, its cultivation, technology and marketing.

This recommendation was accepted by the Government of India and the Indian Central Jute Committee was set up in May, 1936 with its headquarters in Calcutta, capital of Bengal, the main jute growing State of India. The Committee was constituted on the basis of equality of representation between growers and manufacturers with the Vice-Chairman (now Vice-President), Indian Council of Agricultural Research as the Ex-Officio President of the Committee.

The objects for which the Committee is established are as follows:

(a) To undertake, assist or make, in connection with the jute industry in India, agricultural, technological and economic research and propaganda, improvements in crop forecasting and statistics, production, testing and distribution of improved seeds, enquiries and recommendations relating to banking, storage and transport facilities and transport routes, and improvements in marketing;

(b) To advise the Central and local Governments concerned on any point referred to it provided the subject matter of the reference falls within the prescribed functions of the Committee;

(c) To collect and distribute to those connected with the jute industry in India whatever information and statistics becomes available that may assist the various interests concerned.

Consequent on the partition of India into two Dominions, India and Pakistan, the Government of India decided that the Indian Central Jute Committee should continue to function as in the past within the Indian Union under the administrative control of the Government of India.

Accordingly, necessary amendments were made to the then existing rules and regulations of the Committee, and the affairs of the Committee in the Pakistan Dominion were wound up.

ORGANISATION

The Committee was reconstituted with effect from the 1st April, 1956 to give increased representation to the growers on the Committee and the membership roll was increased from 28 to 38. The membership of the Committee after reconstitution stands as below:

(1) Vice-President, Indian Council of Agricultural Research (Ex-Officio President)

(2) Agricultural Commissioner with the Government of India

(3) Four persons to be nominated by the Government of India

(4) Five representatives to the nominated respectively by the Governments of Assam, Bihar, Orissa, Uttar Pradesh and West Bengal to represent their agricultural departments.

(5) One representative of the co-operative movement in West Bengal to be nominated by the Government of West Bengal.

(6) Seven representatives of the jute industry to be elected by the following:
Two members, to be elected by the Indian Jute Mills Association,
Two members, to be elected by the Indian Chamber of Commerce,
One member, to be elected by the Bengal Chamber of Commerce and
One member, to be elected by the Bengal National Chamber of Commerce

(7) One representative of the shipping and baled jute interests to be nominated by the Calcutta Baled Jute Association

(8) Fifteen representatives of the jute growers to be nominated by the Government of India in consultation with the State Governments as under:

(i)	Assam	3
(ii)	Bihar	4
(iii)	Orissa	2
(vi)	Uttar Pradesh	1
(v)	W. Bengal	5

(9) Three members of Parliament of whom two shall be elected from among themselves by the members of the Lok Sabha, and one shall be elected from among themselves by the members of the Rajya Sabha.

FINANCE

At the time of setting up the Indian Central Jute Committee, the Government of India decided to finance the Committee by grants from Central Revenues to the extent of Rs. 5 lakhs a year. The position was to be reviewed after five years or earlier, if necessary. In 1936-37 a grant of Rs. 2 lakhs was sanctioned for the Committee.

After the partition of the country, the Government of India increased the annual grant-in-aid to Rs. 10 lakhs with effect from the financial year 1948-49.

In order to set up a jute agriculture research institute in the Indian Union, the Government of India sanctioned the construction of the ground floor of the Institute at Nilgunge (Barrackpore) and some staff quarters at a cost of Rs. 9,10,460/-. Land for the Institute and experimental farm at Nilgunge measuring about 100 acres was received free of cost from the Government of West Bengal. The Government of India made an *ad hoc* grant-in-aid of Rs. 2.3 lakhs for apparatus and equipments of the Institute. After completion of the ground floor of the Institute, the Government of India sanctioned construction of the first floor of the Institute building and some other staff quarters at a cost of Rs. 11,60,850/-. For these constructions, the Government of India paid to the Committee an additional sum of Rs. 10 lakhs.

In the year 1954-55, over and above the normal annual grant-in-aid of Rs. 10 lakhs, the Government of India made an additional grant-in-aid of Rs. 5 lakhs for expansion of research activities of the Committee.

The Government of India have decided to make available to the Committee under the Second Five-Year Plan (i) a total sum of Rs. 25 lakhs for Central as well as State Governments' research schemes on jute, and (ii) a total sum of Rs. 9.3 lakhs for strengthening of the Technological Research Laboratories and some construction works of the Jute Agricultural Research Institute.

Out of these amounts of Rs. 25 lakhs and Rs. 9.3 lakhs, the Government of India have agreed to pay to the Committee for 1956-57 a sum of Rs. 5 lakhs for research schemes and Rs. 4 lakhs for the construction works at the Jute Agricultural Research Institute and the Technological Research Laboratories.

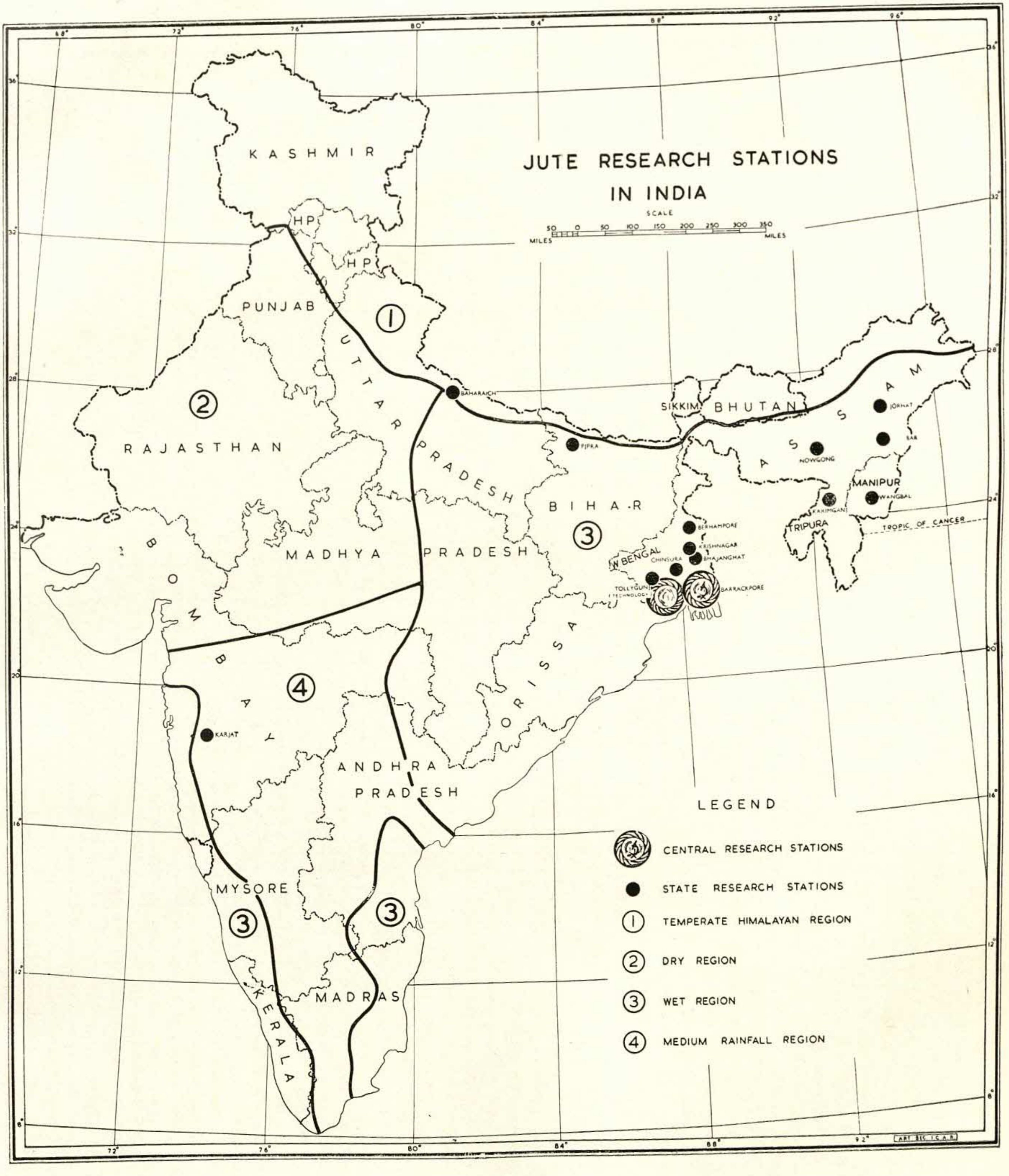
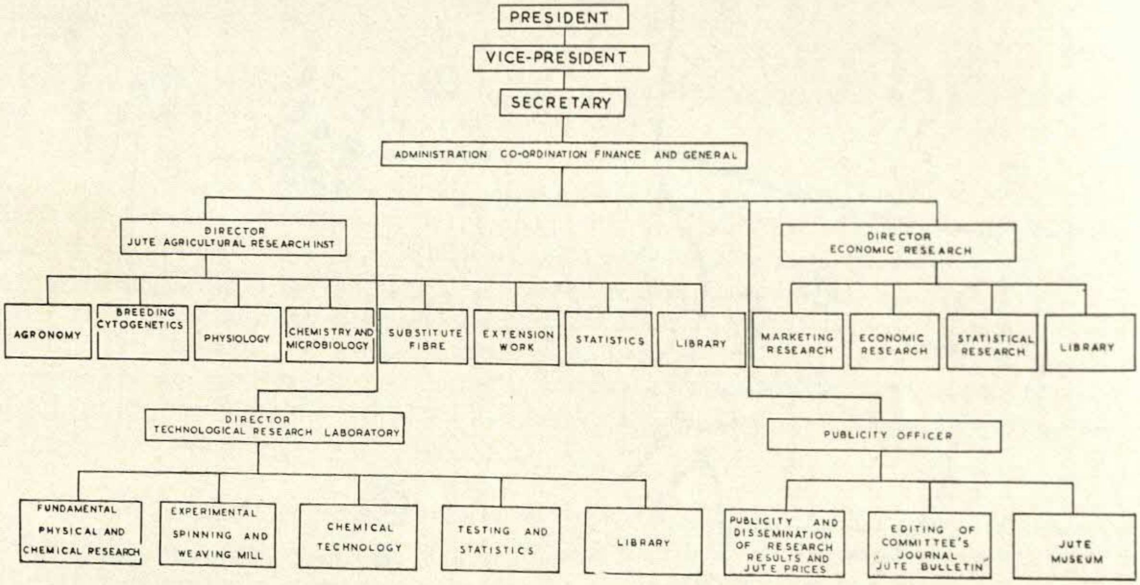

JUTE RESEARCH STATIONS IN INDIA
SCALE
50 0 50 100 150 200 250 300 350
MILES
MILES
KASHMIR
HP
HP
PUNJAB
①
②
RAJASTHAN
UTTAR PRADESH
BAHARAICH
PIPRA
SIKKIM
BHUTAN
ASSAM
JORHAT
BAR
NOWGONG
MANIPUR
WANGBAL
KARIMGANJ
TRIPURA
TROPIC OF CANCER
BIHAR
③
W BENGAL
BERHAMPORE
KRISHNAGAR
BHAJANGHAT
CHINSURA
TOLLYGUNJ (TECHNOLOGY)
BARRACKPORE
BOMBAY
MADHYA PRADESH
ORISSA
④
KARJAT
ANDHRA PRADESH
MYSORE
③
③
KERALA
MADRAS
LEGEND
CENTRAL RESEARCH STATIONS
● STATE RESEARCH STATIONS
① TEMPERATE HIMALAYAN REGION
② DRY REGION
③ WET REGION
④ MEDIUM RAINFALL REGION
68° 72° 76° 80° 84° 88° 92° 96°
36° 32° 28° 24° 20° 16° 12° 8°
ART SEC. I.C.A.R.

PLATE XL]

INDIAN CENTRAL JUTE COMMITTEE

Headquarters—Calcutta (West Bengal)

Organisation Chart


PRESIDENT
VICE-PRESIDENT
SECRETARY
ADMINISTRATION CO-ORDINATION FINANCE AND GENERAL
DIRECTOR JUTE AGRICULTURAL RESEARCH INST
AGRONOMY
BREEDING CYTOGENETICS
PHYSIOLOGY
CHEMISTRY AND MICROBIOLOGY
SUBSTITUTE FIBRE
EXTENSION WORK
STATISTICS
LIBRARY
DIRECTOR ECONOMIC RESEARCH
MARKETING RESEARCH
ECONOMIC RESEARCH
STATISTICAL RESEARCH
LIBRARY
DIRECTOR TECHNOLOGICAL RESEARCH LABORATORY
FUNDAMENTAL PHYSICAL AND CHEMICAL RESEARCH
EXPERIMENTAL SPINNING AND WEAVING MILL
CHEMICAL TECHNOLOGY
TESTING AND STATISTICS
LIBRARY
PUBLICITY OFFICER
PUBLICITY AND DISSEMINATION OF RESEARCH RESULTS AND JUTE PRICES
EDITING OF COMMITTEE'S JOURNAL JUTE BULLETIN
JUTE MUSEUM

The grant-in-aid from the Government of India is the only source of finance of the Committee. A very meagre sum is obtained annually from the sale proceeds of Committee's publications, jute fibre and seed and other farm produce.

Pattern of financial assistance

The Committee finances research and development schemes which are submitted by the States, Universities and the Research Institutes. Non-recurring expenditure on schemes is not ordinarily borne by the Committee. Recurring expenditure on agricultural research schemes is met by the Committee in full up to a period of 10 years ; thereafter only 50 per cent of the recurring expenditure is borne by the Committee. In case of technological research schemes, recurring expenditure is borne by the Committee in full up to a period of 3 years only. The schemes which do not fall under the above categories are financed up to a limit of 50 per cent of the net recurring expenditure.

JUTE AGRICULTURAL RESEARCH INSTITUTE

Barrackpore (West Bengal)

THE Jute Agricultural Research Institute consists of the following Sections: (1) Botany (breeding and genetics), (2) Anatomy, (3) Cytogenetics, (4) Physiology, (5) Agronomy, (6) Chemistry and Microbiology, (7) Mycology, (8) Entomology, (9) Substitute fibres, (10) Statistics and (11) Extension. A large number of problems have been included in the programme of research carried out in the different Sections. Some of the important results are outlined below.

Botany

A collection has been built up of varieties and types of both indigenous and exotic species of *Corchorus*, including wild species. Breeding of improved strains has been undertaken by selection as well as by hybridisation. Induction of polyploidy in jute as also interspecific hybridisation have been attempted. Another problem which is receiving attention is breeding for disease resistance. The isolation and maintenance of genetic strains have also received attention as also the study of the inheritance of characters. The study and structure of the jute fibre are other important subjects of researches. Studies have also been undertaken on the effect of fertilizers on the formation and development of fibre and also on the effect on growth and maturity of their structure. The cytology of the wild and cultivated types of *C. capsularis* and *C. olitorius* is under study.

Studies have been undertaken on the root system in different jute species, as also growth studies as related to the yield of fibres. Flowering, seed formation, vernalisation, and photoperiodism have received attention. Sand-culture experiments at different levels of nutrition and trace elements have been carried out.

Agronomy

In the field of agronomy intercultural experiments including those on row cropping and spacing between plants have been conducted. Studies have been undertaken on green manuring and manurial trials. The chemical and mechanical constituents of jute soils as also depletion of soil nutrients have been studied.

Improvements have been effected on the retting technique and colour-quality of fibres.

Mycology

Studies have been initiated on the stem-rot fungus, *Macrophomina phaseoli* and also on the effect of environmental factors on secondary infection due to the pathogenic activities of the fungus. Other diseases of jute, e.g. anthracnose, soft rot, and wilt are also under study.

Entomology

The biology and life-history and control of various pests of jute are under study, e.g. the jute stem girdler, stem weevil, caterpillar pest, etc. Investigations have also been undertaken on the residual effects of insecticides on jute soils.

Substitute fibres

Researches have been carried out on a number of fibre-yielding plants with a view to ascertaining the possibilities of such fibres being used as jute substitutes. In planning their investigations, agronomical, botanical, economic and technological aspects have been kept in view.

IMPROVED STRAINS OF JUTE

A number of improved strains of *C. capsularis* and *C. olitorius* have been evolved to suit different environmental conditions of the jute growing areas of the country. The important ones are :

C. capsularis — JRC-212
JRC-321
C. olitorius — JRO-632
JRO-753
JRO-620

Increased yield of about two maunds per acre for *capsularis*, and four maunds per acre of *olitorius* over local types have been obtained by the use of improved strains. In addition to the above, a number of improved strains to suit local conditions are at present under trial.

Of the *capsularis* strains, JRC-212 is a late type giving high yield and better quality of fibre. The strain JRC-321 is a quick growing and early maturing type, and yields fibre of very good quality. This strain is highly suitable for low-lying areas where it can be sown early and harvested early for double or triple cropping purpose. Among the *olitorius* strains, JRO-632 and JRO-753 are the highest yielders, and JRO-620 is reputed for its high yield and excellent fibre quality.

IMPROVED CULTURAL PRACTICES

Row cropping of jute

Growing jute in lines is recommended as against the traditional method of broadcasting. In row cropping the cost of interculture is reduced to less than half of that of broadcast method as it is possible to operate a wheelhoe for this purpose. Row cropping eliminates wastage in seed rate by about 50 per cent, ensures uniformity of crop, reduces cost of production by about 20 to 30 per cent and finally improves the quality of fibre. To facilitate sowing in lines, the J.A.R.I. has evolved a suitable jute seed drill in collaboration with a local firm.

Manurial practices

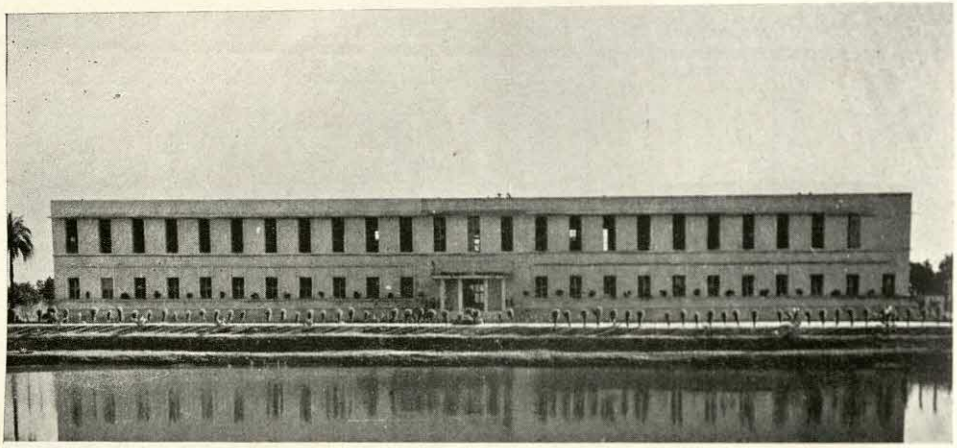
Application of 20 to 40 lb. of available nitrogen per acre from both organic and inorganic sources is recommended for jute. A dose of 40 to 80 maunds of compost per acre at the time of land preparation followed by 50 to 100 lb. of ammonium sulphate as top dressing when the crop is about one month old should be applied. Application of potash has been found to check disease to an appreciable extent thereby contributing towards the increase in yield. Twenty-five to 50 lb. of muriate of potash per acre may be applied. In acidic soils, lime should be applied as basal dressing at the rate of 3 to 6 maunds per acre at least 3 to 4 weeks before sowing. Depending on the fertility of soil, the yield has been found to increase by 30 to 200 per cent by judicious application of manure.

Top Dressing

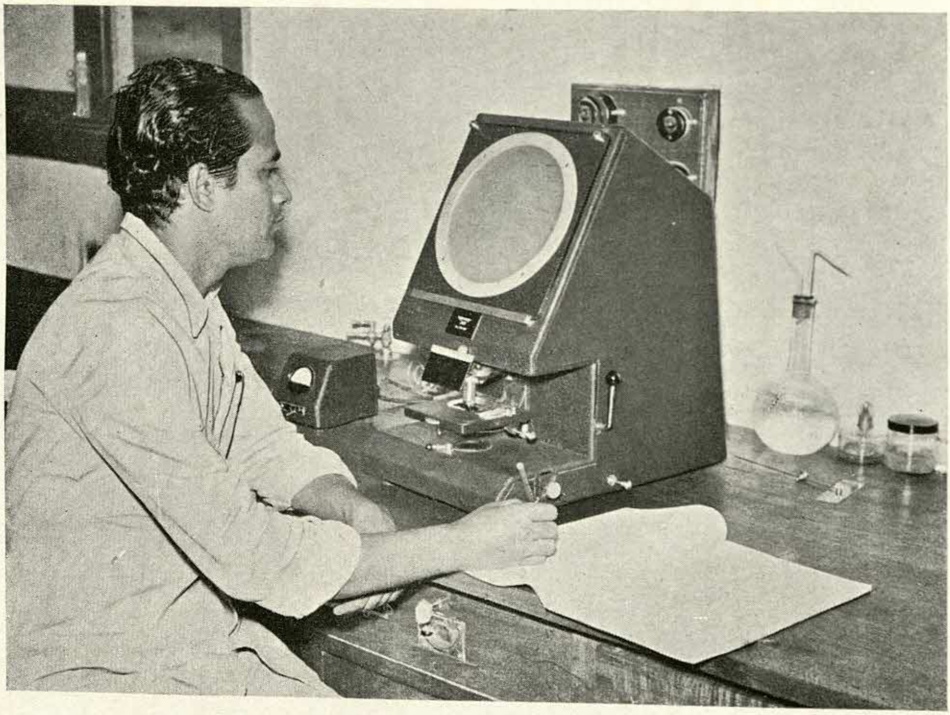
As jute is a monsoon crop, nitrogenous fertilizers are leached off often during heavy rains. In view of the results of research and other considerations, namely, loss due to leaching and loss due to the nutrients being utilised by thinned out plants during weeding operations, it is desirable that in jute ammonium sulphate, the recommended source of inorganic nitrogenous fertilizer should be applied as a top dressing.

Line-sown jute crop at the Central Jute Agricultural Research Institute Farm, Barrackpore

Harvesting of jute at Central Jute Agricultural Research Institute Farm, Barrackpore



Central Jute Agricultural Research Institute, Barrackpore



Measuring fibre cells with fibroscope at the Anatomy Section, Central Jute Agricultural Research Institute, Barrackpore

Double cropping with jute

Where conditions are favourable *C. capsularis* can be grown successfully as the first crop in transplanted *aman* paddy lands that are usually single-cropped. By growing jute, soil is not depleted so far as total nitrogen is concerned. The soil nitrogen which is exhausted during the growth of the crop is replenished by the huge amount of leaf fall during the growth period and at harvest of the jute. Preliminary results of double cropping experiments have shown that it is possible to maintain or even increase the paddy yields in lands where jute is grown as the first additional crop.

Proper stage of harvest

Jute should be harvested when the plants are in small pods because at this stage the best combination of yield and quality is obtained.

IMPROVED RETTING TECHNIQUE

The bundles for steeping should be about 8 inches in diameter and laid on the ground for two to three days. During this period leaves fall on the land and the tissues shrink and the cells rupture. This facilitates entry of micro-organisms into the stems when steeped in water. For weighting down the bundle in the jak (platform of jute bundles laid flat in water), use of earth, banana stems or freshly cut log of mango and *bel* should not be used. These are rich in tannin and the tannin coming in contact with the iron of the retting water discolours the fibre. Aquatic plants are more suitable as covering materials.

Jute bundles have been found to ret better when steeped at a depth of 6 to 9 inches, in slow flowing clear water. In jute the top portion rets earliest and the bottom last, resulting in uniform fibre. Jute will ret more uniformly when the bottom of jute bundles are kept standing in water one to two feet deep for two to three days before steeping the whole bundle.

During the hotter months of the season the retting is quicker and quality of fibre is better. Addition of small amounts of ammonium sulphate and bone dust hastens retting considerably, particularly in colder months.

Extraction

The method of extraction of fibre separately from single retted sticks as against usual bundlewise method, though slightly costlier, produces fibre of better quality and minimises wastage of fibre.

IMPROVEMENT OF SHYAMLA COLOUR OF JUTE

The grey black colour of fibre, known as the *shyamla* colour, often produced by faulty retting practices can be removed by washing the fibre with two per cent tamarind extract.

Jute plants contain tannin which is more in *C. olitorius*. When jute is retted, the tannin comes into solution and with the dissolved iron of the retting water, a black colour is formed, and the fibres become coloured. This is known as *shymala* colour. If plants are several times steeped in the same retting tank the fibres become more and more coloured. The colouration is more when banana stems, or freshly cut logs of mango or *bel* are used. This fibre fetches comparatively less price. It has been found that this colour can be removed by treatment with mineral and organic acids. The strength of the fibre is lessened when treated with mineral acids but with organic acids it is not so. The cost of treatments with organic acids is very high. It has also been found that if treated with tamarind extract, the colour of the fibre can be improved. Technological tests reveal that the fibres treated with tamarind extract have a slightly better quality ratio than the untreated fibres. The cost comes to about 12 annas per maund including the cost of labour.

CONTROL OF DISEASES OF JUTE

The main diseases of jute are: (i) stem-rot caused by the fungus *Macrophomina phaseoli*, (ii) Anthracnose due to *Colletotrichum sp.* and (iii) soft-rot caused by *Sclerotium rolfsii.* The following recommendations are made to combat the diseases caused by the *M. phaseoli* and *Collectotrichum* sp:

(a) Seed treatment with organo-mercuric compounds like AgrosanGN when the soil is comparatively free of the pathogen but seed is infected

(b) When the soil is highly infected—
  (*i*) rotation of paddy for two years successively,
  (*ii*) application of lime (usually 8 maunds per acre) according to necessity,
  (*iii*) application of 20 lb. of muriate of potash per acre and
  (*iv*) removal of infected jute stubbles after deep ploughing

(c) To avoid secondary infection (i) early sowing with the first north-western showers and (ii) timely weeding and proper thinning

(d) To check secondary infection of stem-rot, spraying of Bordeaux mixture 4:4:40 and/or, copper-oxide or colloidal copper 1/2 per cent and for checking soft-rot, occasional mulching of the soil and spraying of colloidal copper on ground or copper sulphate 0.1 per cent at the base of the stem are recommended

CONTROL OF PESTS OF JUTE

The important pests of jute are indigo caterpillar, jute semilooper, hairy caterpillar, jute stem weevil or jute apion, mites, Pseudococus and jute stem girdler. The following control measures are recommended to combat these pests.

(a) Indigo caterpillar (*Laphygma exigua*), Jute semilooper (*Anomis sabulifera*) and hairy caterpillar (*Diacrisia obliqua*)—spraying of 0.5 per cent wettable DDT, Endrin 0.03 per cent, Folidol 0.005 per cent

(b) Jute stem weevil or jute apion (*Apion corchori*)—spraying or dusting of B.H.C. or D.D.T. as prophylactic measures

(c) Mites (*Hemitarsonemus latus*—Yellow mite; *Tetranychus bioculatus*—Red mite)—dusting of lime sulphur 3:1 at an interval of 24 hours, operation to be repeated if necessary

(d) Pseudococcus—Spraying of 1.0 per cent to 1.5 per cent nicotin sulphate

(e) Jute stem girdler (*Nupserha bicolor Ssp. postbrunnea*)—*Capsularis* jute is resistant to this pest, while *olitorius* is highly susceptible. Measures like (i) growing of *capsularis* jute in highly infested areas, removal of affected plants during thinning operation, (ii) destruction of eggs by removal of the apical portion along with the rings of the attacked plants before the leaves dry up and (iii) removal of small pieces of stem containing the dormant larva inside, found on the surface of the soil after the harvest of the jute.

The Substitute Fibres Section within the short period of its existence has made very satisfactory progress. Two improved strains *Hibiscus sabdariffa var. altissima*—one for high fibre yield and another for non-bristle character of the stem have been evolved. In *H. cannabinus* large number of selections for high fibre yield and resistant to diseases have been made. The Section has also been able to evolve an improved high-yielding type of sunnhemp which has given satisfactory performance in trials conducted in the different States.

EXTENSION OF IMPROVED METHODS

The scheme on 'Extension of improved methods of jute cultivation' is functioning in this Institute in order to popularise amongst the growers the various results of research obtained at the Jute Agricultural Research Institute by wide scale propaganda and demonstrations through various extension centres. Work has been started in West Bengal in one Developments Block with six extension centres around the Jute Agricultural Research Institute. Trials are conducted in a large number of demonstration plots scattered in the different villages of these centres and all the improvements recommended, are tested and confirmed in the farmers' fields. Individual and group contacts are also made and meetings held regularly by the extension staff. The extension scheme envisages the opening of six more developmental blocks in the different jute growing States.

JUTE TECHNOLOGICAL RESEARCH LABORATORIES

Calcutta (West Bengal)

THE Technological Research Laboratories, which constitute a part of the Indian Central Jute Committee, started work in the autumn of 1938. Technological problems relating to jute are tackled in these laboratories and an idea of the problems investigated may be obtained from the subjects listed below:

1. Assessment of the quality, by spinning trials, etc. of fibre samples produced as a result of the Committee's agricultural activities
2. Studies of the relationship between measurable physical and chemical fibre characters and spinning quality and properties of woven fabrics
3. Spinning trials of commercial samples
4. Fundamental and background research including X-ray studies on jute fibre
5. Studies on the spinning process
6. Studies on the weaving process
7. Microbiological studies
8. Chemical technology of jute fibre
9. New uses of jute
10. Utilisation and prevention of waste

At the time the laboratories were started, they were not fully equipped to handle all kinds of problems relating to the technology of jute. Since 1947-48 extensions of the buildings have been made to accommodate Weaving Section, fibre sampling room, X-ray laboratory, microbiological laboratory and Chemical Technology Section. The construction of a new three-storyed building of approximately 29,000 sq. ft. plinth area has been started. This building, when complete, will accommodate chemical technology, applied physics, physical chemistry and microbiology departments.

The present scientific staff of the laboratories consists of 45 members and when the expansion schemes are in full operation, the technical staff will be composed of 60 members.

The laboratory is equipped with a good workshop and makes many of its own apparatus according to the designs put up by research workers. Many such apparatuses are in use in the various departments of the laboratories.

The results so far obtained from experiments conducted in the various departments may be summarised as follows:

Mesta fibre can be successfully used, blended with jute fibre, to spin good quality yarn. Linseed fibre can also be spun on jute machinery and used in making sacks.

The dark grey colour of *shyamla* jute may be removed by a simple and cheap chemical process. The patented process of brightening dark hessian is now in daily use in some 20 jute mills in India.

The formation of syrup in sugar bags during storage or transport may be largely prevented by chemical treatment.

Jute root cuttings which are considered as waste and cannot be spun easily, may be softened to spinnable fibre by both chemical and microbiological treatments.

Some properties of wool can be imparted to jute fibre by chemical processing and thereafter such fibre may be used for blending with wool in the manufacture of cheap blankets, wrappers, etc.

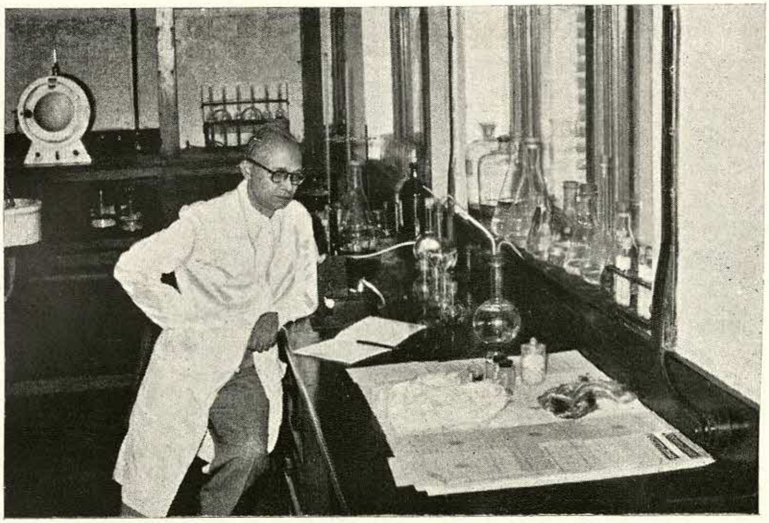
A very cheap process of preserving sizing paste has been developed.

The mechanical properties, elastic modulus, rigidity, flexibility, etc. which control the spinnability of the fibre as well as the feel, quality of the fabric when produced, have been measured.

The variation of the chemical constituents of the fibre, e.g. cellulose, hemicelluloses, fat and wax, etc. from sample to sample have been determined and correlations have been found out in respect of their spinning property. Investigations are in progress for studying the chemical nature of these constituents and to what extent they affect the properties of the fibre.

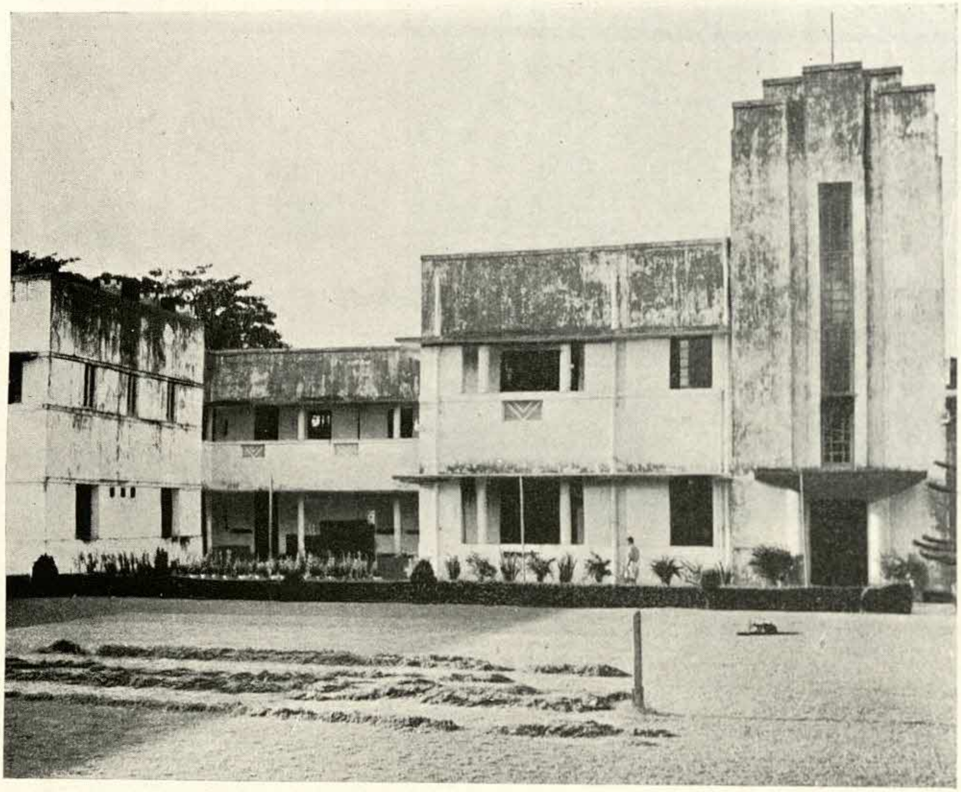
The fine crystalline structure of cellulose has been studied by X-rays, and a relation has been established between the micelle length and the tensile strength of the fibre.

Numerous papers have been published on the results of the work of these laboratories. The industry is regularly apprised of the results by such publications as technological memoirs, pamphlets, circulars and leaflets, etc. so that they may adopt the techniques developed in these laboratories.

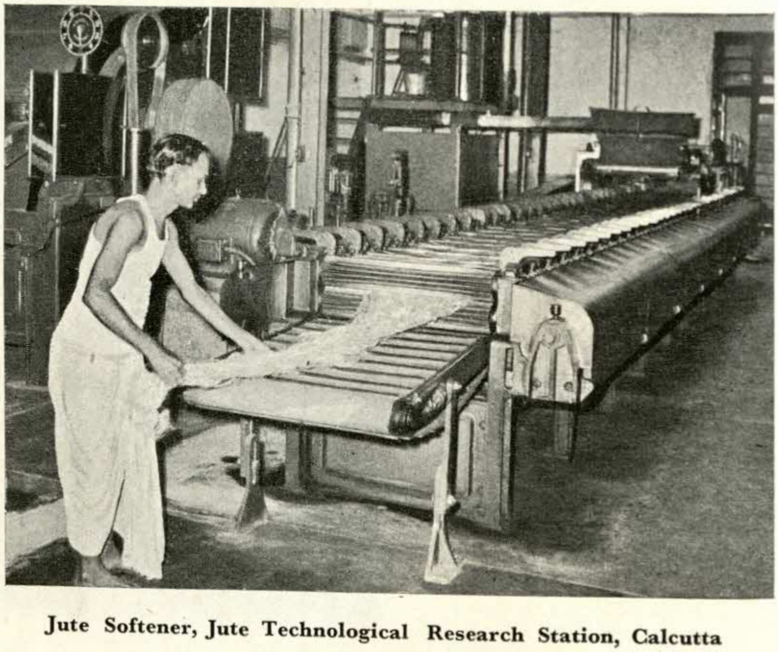


Chemical Laboratory, Jute Technological Research Station, Calcutta

Drawing Frame, Jute Technological Research Station, Calcutta



Jute Technological Research Station, Calcutta



Jute Softener, Jute Technological Research Station, Calcutta

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL JUTE COMMITTEE

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Chemical utilisation of jute and jute waste	Calcutta University	11½ years (1941-53)	0.76	To find out new uses of jute waste by chemical treatment	Some plastic materials using urea and acid were made. A process for conversion of jute waste into thermosetting moulding powder and the moulded production were patented by the I.C.J.C.	
X'ray investigation of jute fibre	Calcutta University	8½ years (1942-51)	0.62	To determine the fibre structure of cellulose in jute and to see how this is related to its physical properties	The structure of cellulose in jute fibre, is almost the same as that of other cellulosic fibres. When lignin is removed from the fibre, the size of the crystalline region slightly varies. The strength of jute fibre depends partly on the size of these crystallites	Scheme transferred to the I.C.J.C. from 1-3-1951
Resin impregnation	Dacca University up to 1947 and Bose Institute, Calcutta thereafter	11½ years (1942-54)	0.82	To improve the bleached or delignified jute strength and colour	By introducing urea and melamine-formaldehyde resins, the wet strength of bleached jute yarns and fabrics was increased considerably. The treated material stood soap wash fairly well. The white colour of resinated bleached-jute was maintained on storage	Scheme transferred to I.C.J.C. from 1-1-1954
Research on the physiology of jute plant	Calcutta University	6 years (1945-51)	0.33	Detailed study of the physiology of jute plant in order to effect improvement in its cultivation	Findings of the research published	—
Biochemical investigation of the process involved in retting of jute	Calcutta University	11 years (1942-53)	0.53	To investigate the various chemical reactions which occur during the process of retting with a view to speeding up the process	—	Scheme transferred to I.C.J.C. from 1-4-1953
Research on effect of X'rays, neutrons and gamma rays on jute	Bose Institute, Calcutta	9½ years (1945-55)	0.80	To induce desirable hereditary changes in the seeds of jute plants by subjecting them to different kinds of ionizing radiations	The basal diameter of the plant and its height showed increases when the plants were grown from irradiated seeds of varieties D154, R26, and C. G. Earliness in flowering has also been observed in all the three varieties of treated seeds	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL JUTE COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Growth and development of jute fibre	Calcutta University	3 years (1942-45)	0.09	To study the fibre from three standpoints: (*a*) wall structure, (*b*) methods of secondary deposition during the growth of the plant, (*c*) methods of distinguishing the fibres of *C. olitorius* from those of *C. capsularis*	Study made and report issued	
Cyto-embryological research on species of jute	Dacca University	2½ years (1943-45)	0.06	To study cyto-embryological aspects of species of *C. olitorius* and *C. capsularis*	Study made and report submitted	
Radiation mutation in jute	Bose Institute, Calcutta	—	0.15	Studies of effects of different types of radiations on seeds and seedlings, flower buds and pollen grains of jute plants with a view to evolving high-yielding and disease-resistant varieties of jute	—	Scheme current
Studying effect of gamma irradiation on jute and oilseeds	Bose Institute, Calcutta	—	0.15	To study the effect of Cobalt rays on the growth of jute and oilseeds	—	Scheme will start shortly
Development of Bimlipatam jute	Andhra Pradesh	—		To study the development of Bimlipatam jute	—	Scheme will start shortly

INDIAN CENTRAL COCONUT COMMITTEE

Headquarters—Ernakulam (Kerala State)

THE Indian Central Coconut Committee was set up in February 1945 under the Indian Coconut Committee Act 1944. The Committee has its headquarters at Ernakulam in Kerala State. The background against which the Committee was set up is indicated below.

Prior to the First World War, India had been exporting fairly appreciable quantities of copra and coconut oil to foreign countries. But the conditions created by the war, and the fillip it gave to the vegetable-oil industry and the soap and toilet goods industries in India made it necessary for the country to import large quantities of copra and coconut oil to meet its needs. The occupation of some of the principal coconut growing countries in the East, viz. the Philippines and Indonesia by Japan during the Second World War caused an acute shortage in the supply of copra and coconut oil in India. This situation attracted the attention of the Government of India and it was thought necessary to take steps to intensify the production of coconut so as to make the country self-sufficient in the commodity.

History

The Government of India decided to set up an all-India organisation to watch over the interests of coconut growers and take steps for the development of the coconut industry in all its aspects. Accordingly, the Indian Coconut Committee Act was passed by the Central Legislature in 1944, and the Indian Central Coconut Committee ushered into existence in February 1945. The functions of the Committee fall under four main heads, viz. (i) undertaking, assisting or encouraging agricultural, industrial and economic research, (ii) improving the marketing of coconuts and coconut products, (iii) supplying information regarding the coconut industry to the general public, giving technical advice to the growers and carrying on propaganda in the interests of the coconut industry, and (iv) tendering advice to the Central Government in respect of policy in matters connected with the development and improvement of the coconut industry.

COCONUT IMPROVEMENT FUND

The Indian Coconut Committee Act provides for the creation of a fund called the 'Cocount Improvement Fund' which is to be expended by the Committee in the discharge of its functions. A cess at the rate of four annas per cwt. of copra (indigenous and imported) crushed in all the power operated mills is collected by the Central Excise Department and credited to the Fund from time to time. Prior to the 1st April 1953, the cess used to be collected only from mills coming under the purview of the Indian Factories Act. From the 1st April 1953, however, the cess has been collected from all power mills by virtue of the Indian Coconut Committee (Amendment) Act, 1952. The average annual income from the cess for the three years ending 1955-56 was of the order of Rs. 6.7 lakhs.

The Committee's funds are spent on the following:

(1) Administration
(2) Travelling allowances of non-official members
(3) Research undertaken at the Central Coconut Research Stations at Kasaragod and Kayangulam
(4) Grant-in-aid to research and development schemes sponsored by State Governments.
(5) Publicity and propaganda.

For the year 1956-57 the amounts provided for the above items of expenditure are as follows:

(1) Administration	Rs. 1.78 lakhs
(2) Travelling allowances on non-official members	0.07 „
(3) Research at Central Coconut Research Stations	4.28 „
(4) Grant-in-aid	2.70 „
(5) Publicity and propaganda	0.60 „

The total estimated receipts for the year are Rs. 12.34 lakhs and the closing balance is expected to be Rs. 1.91 lakhs after paying back to the Government of India a loan instalment of Rs. 1.00 lakh.

Pattern of financial assistance

Research schemes are financed by the Committee up to a period of 10 years, the Committee meeting 50 per cent of the recurring expenses. To justify further financial help from the Committee, after this period it is necessary to give special technical or scientific reasons.

Co-operative marketing schemes are sanctioned by the Committee for an initial period not exceeding five years, the Committee meeting 50 per cent of the recurring expenditure but they may be extended subsequently for a further period not exceeding three years on the condition that the Committee's share of expenditure does not exceed 33⅓ per cent of the recurring expenditure.

Coconut nursery schemes are sanctioned by the Committee for a period of five years in the first instance, the Committee meeting 50 per cent of the recurring expenditure but may be extended for a period not exceeding five years on the condition that the Committee's share of expenditure does not exceed 33⅓ per cent of the recurring expenditure. The schemes may be extended for a further period not exceeding five years provided the Committee's share of expenditure does not exceed 15 per cent of the recurring expenditure.

The receipts, if any, realised from the working of the schemes are shared by the Committee and the State Governments concerned in the proportion in which the recurring expenditure is shared.

Schemes

The Committee extends grant-in-aid for (i) schemes for the establishment of regional coconut research stations for undertaking research on the cultural and manurial aspects of coconut cultivation, (ii) schemes for the establishment of coconut nurseries for raising and distributing quality coconut seedlings to the growers at concession rate, (iii) schemes for the establishment of co-operative marketing societies for enabling the growers to get a fair price for their coconuts and coconut products, (iv) schemes for the development of coconut cultivation and (v) schemes for the chemical and biological control of pests and diseases of the coconut.

ORGANISATION

The Committee consists of 36 members as shown below:

(a) Representatives of the coconut growers—12 (nominated by the Governments of coconut growing States—4, nominated by the Kerala Government—3, by the Madras Government and one each by the Governments of Mysore, Andhra, Bombay, Orissa and West Bengal).

(b) Representatives of Coconut Oil Industry—5 (2 nominated by the Kerala Government, and 1 each by the Madras Government, the Indian Merchants' Chamber, and Bombay Chamber of Commerce).

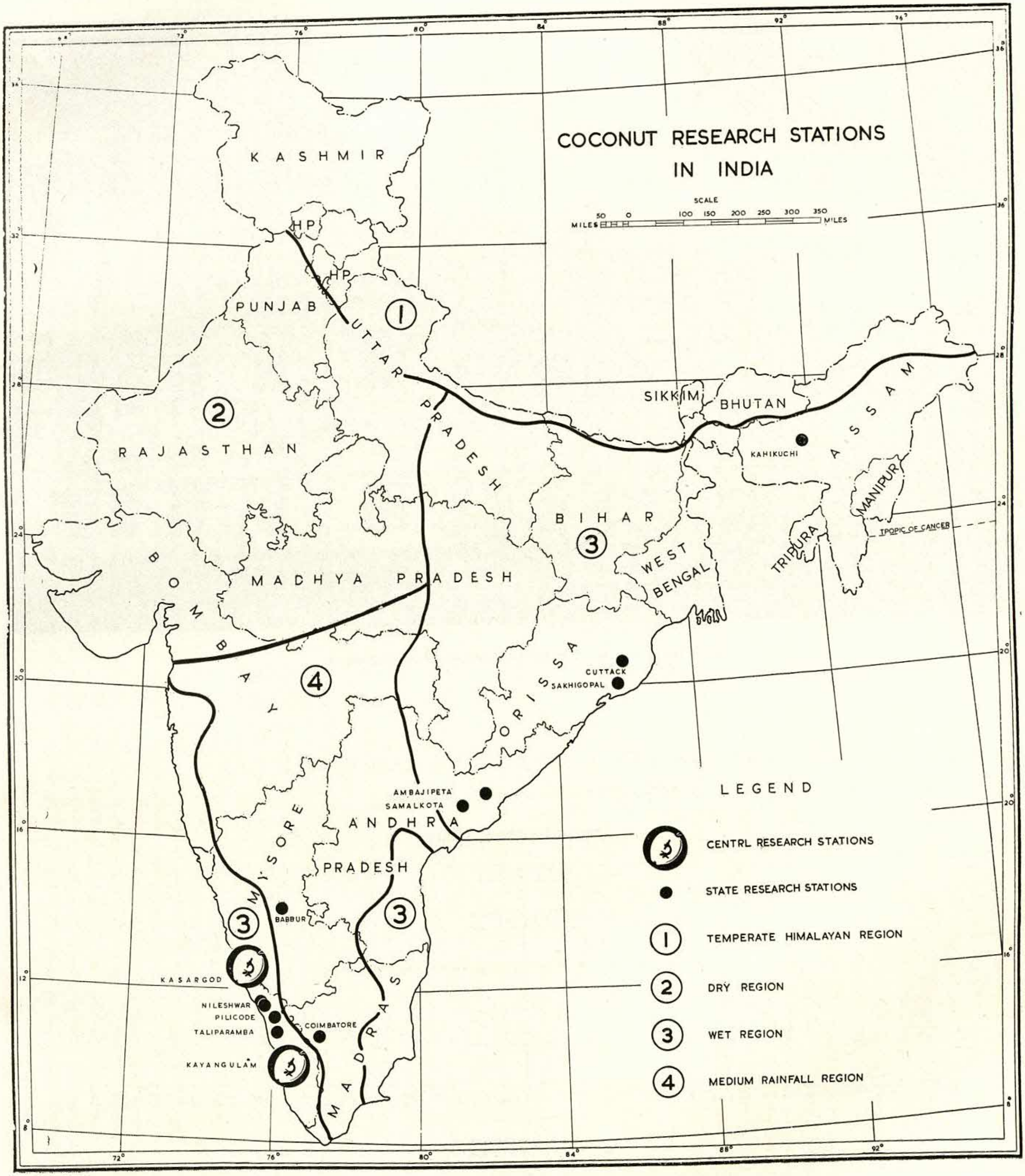
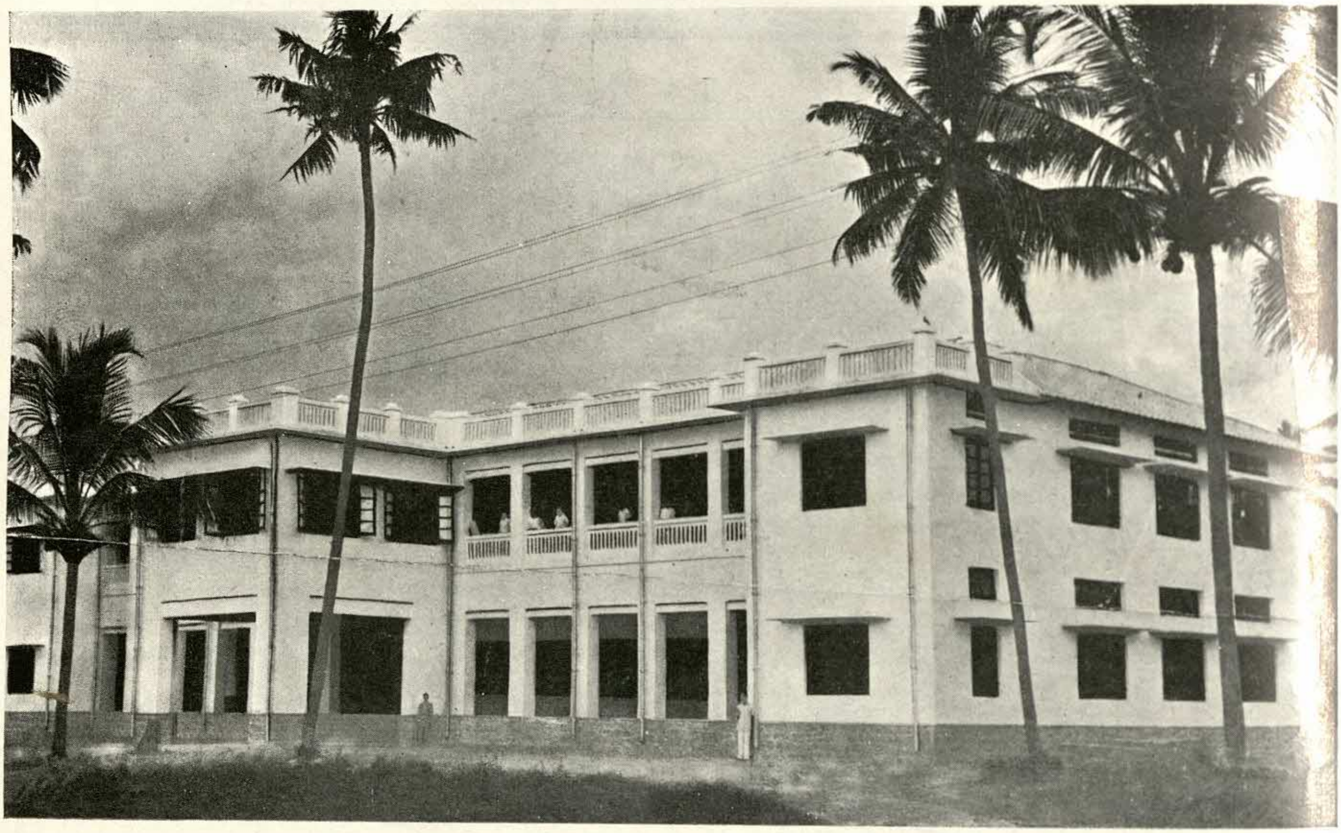

COCONUT RESEARCH STATIONS
IN INDIA
SCALE
MILES 50 0 100 150 200 250 300 350 MILES
KASHMIR
HP
HP
PUNJAB
1
UTTAR PRADESH
2
RAJASTHAN
SIKKIM
BHUTAN
ASSAM
KAHIKUCHI
MANIPUR
TRIPURA
TROPIC OF CANCER
BIHAR
3
WEST BENGAL
BOMBAY
MADHYA PRADESH
4
ORISSA
CUTTACK
SAKHIGOPAL
AMBAJIPETA
SAMALKOTA
ANDHRA PRADESH
MYSORE
3
BABBUR
3
KASARGOD
NILESHWAR
PILICODE
TALIPARAMBA
COIMBATORE
KAYANGULAM
MADRAS
LEGEND
CENTRL RESEARCH STATIONS
STATE RESEARCH STATIONS
1 TEMPERATE HIMALAYAN REGION
2 DRY REGION
3 WET REGION
4 MEDIUM RAINFALL REGION
72°
76°
80°
84°
88°
92°
96°
8
12
16
20
24
28
32
36

PLATE XLVI]

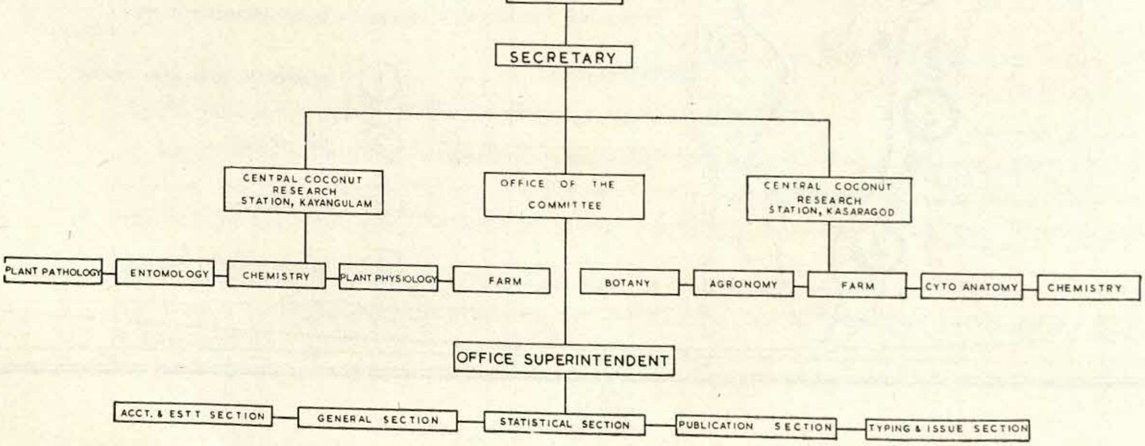


Central Coconut Research Station, Kayangulam

INDIAN CENTRAL COCONUT COMMITTEE

Headquarters—Ernakulam (Kerala)

Organisation Chart



(c) Representatives of Central Government—7 (The Vice-President, Indian Council of Agricultural Research and the Agricultural Marketing Adviser to the Government of India are members ex-officio. The Central Government can nominate 5 others. They have so far nominated only two, the Agricultural Commissioner with the Government of India and the Additional Agricultural Commissioner)

(d) Representatives of State Governments—8 (One each nominated by the Kerala, Mysore, Madras, Andhra, Bombay, Orissa, West Bengal and Assam Governments).

(e) Representative of the Travancore Chamber of Commerce—1

(f) Representatives of consumers elected by Parliaments—3 (2 elected by the Lok Sabha members from among themselves and one elected by the Rajya Sabha members from among themselves).

The President of the Committee is appointed by the Government of India. Any member of the Committee or any other person may be appointed as the President of the Committee.

The members of the Committee elect every year one among themselves as the Vice-President for a period of 12 months from the 1st May. Various sub-committees for the same period are also set up every year.

ACHIEVEMENTS

As research is essential for better and more economic production of coconuts, the Committee has set up two Central Coconut Research Stations one at Kasaragod in Cannanore District for work connected with botanical, breeding, genetical, manurial and other agronomic aspects of coconut, and the other at Kayangulam, in Quilon District, for carrying out investigations on the pests and diseases of the coconut palm.

CENTRAL COCONUT RESEARCH STATIONS

CENTRAL COCONUT RESEARCH STATION, KASARGOD (KERALA)

INVESTIGATIONS carried out at this Station have shown that the varieties Laccadive Ordinary, Laccadive Small, Fiji, Straits Settlements and Gangabondam are economic varieties. Seedlings of these varieties are being raised at the Station in limited numbers and distributed to growers.

Important work done at the Station

Study of indigenous varieties. The results indicate that seedlings of the varieties Gangabhavani and Verrikobbari obtained from Andhra State produced more leaves in a year than other indigenous varieties.

Study of mother palms. Out of about 6,000 trees of the Station, about 1,000 trees have been selected on the basis of yield and nut characters, as mother palms suitable for propagation.

Hybridisation. This work has shown that by hybridisation, desirable characters found in different varieties or individuals can be brought together in an individual. Hybrid seedlings are being produced in limited numbers for supply to growers.

Button-shedding Among the eight different hormone mixtures under trial, sprays of p. chlorophenoxy acetic acid in 30 p.p.m. strength and a mixture of p. chlorophenoxy acetic acid in 20 p.p.m. plus 2,4-D and coconut water have proved to be successful in controlling shedding of buttons (immature nuts).

Occurrence of barren nuts. Spraying inflorescences of trees producing barren nuts with cow's urine reduced barren-nut production to 7-11 per cent.

N.P.K. manurial experiment. This experiment to obtain data regarding the response of the trees to the application of major elements, N,P and K singly and in combination and in different levels, is being conducted.

Cultural experiment. This study has shown that highest yields are obtained from the plots which are regularly cultivated and manured. The yield is very low in neglected plots. The yield is also high in the regularly cultivated plot. Ploughing has proved to be the cheapest of the cultural operations.

Chilean nitrate experiment. This study has shown that chilean nitrate is better than ammonium sulphate as a source of nitrogen to coconut trees.

Husk burial in seedling pits. It has been shown that burying of husks is of some benefit to the newly planted seedlings for the first two or three years.

Yield studies. It has been found that 13.5 per cent of the annual production of nuts is obtained in April and that 34.1 per cent is obtained during the summer months of March, April and May.

Nursery studies. It has been found that 96.2 per cent of seednuts harvested in March and 89.8 per cent of those harvested in May germinated. The death of young sprouts was maximum in seednuts harvested in February.

Irrigation with sea water and fresh water. Watering improved the condition and yield of trees. There was no evidence of any adverse effects consequent on the use of sea water.

Burial of husks in coconut plantations. Burial of husks has been found to be beneficial to coconut palms for 5-6 years.

Effect of transplanting on coconut palms. Transplanting was found to cause setback to the growth of the palm for over two years.

Root pruning to induce bearing. Root pruning is found to be effective in inducing the palms to produce inflorescences.

Establishment and growth of seedlings in relation to planting pit. Best growth was exhibited by seedlings planted in fresh pits subjected to charring.

Observations on green manure crops on a field scale. Calopogonium mucunoides proved to be suitable for growing in coconut plantations.

Glyricidia pruning trials. The green manure bush of *Glyricidia* was pruned at intervals of 1 month, 2 months and 3 months. Three months interval proved to be better than the other two.

Durability of plaited coconut leaves. Deterioration was the least in dry leaves soaked in brackish water.

Soil moisture studies. These revealed that the differences in the moisture contents of seedling pits have no influence on the growth of seedlings.

Studies on copra making. Copra making by *chula* copra dryer was found to be uneconomical although the copra produced was excellent.

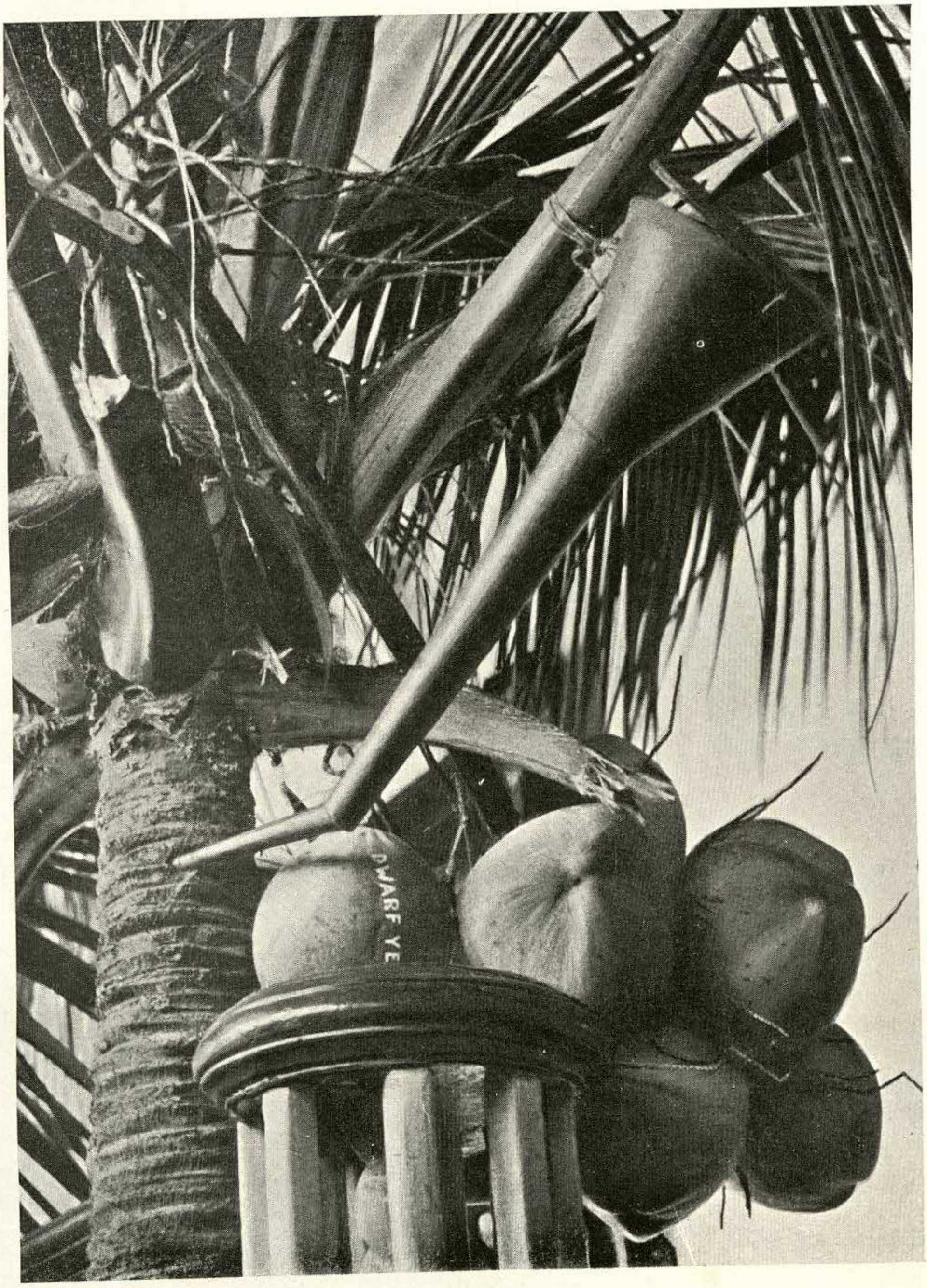
Studies on storage of coconut oil. It was found that deterioration in the quality of coconut oil on storage could be reduced by adding common salt to the oil.

CENTRAL COCONUT RESEARCH STATION, KAYANGULAM (KERALA STATE)

Control of leaf disease. It has been found that spraying with copper fungicide could keep the leaf disease under control. The treated palms gave higher yields by arresting button-shedding and disease infection to the succeeding leaves. Bordeaux mixture (1 per cent) was found to be the best fungicide.

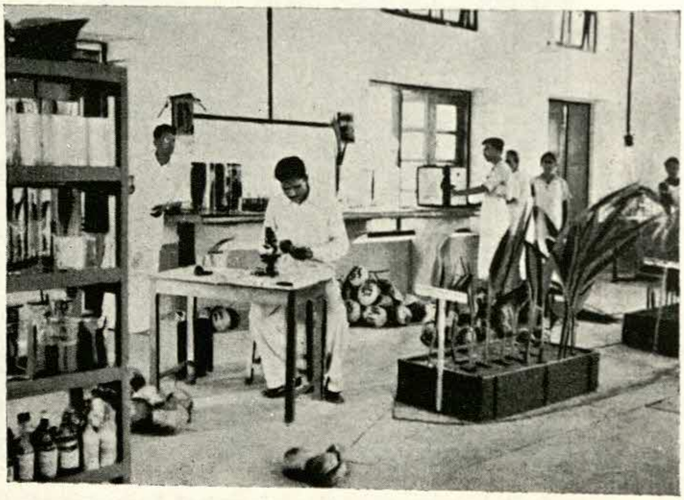
Control of root disease. It has been found that a manurial-*cum*-spraying treatment adopted in an infected garden would lead to economic yields. An application of N.P.K. plus lime plus cattle manure with spraying to the foliage gave good results. The addition of lime at the rate of 4 cwts. per acre has also been found to be beneficial.

Control of the Rhinoceros beetle—The following control measures have been found to be effective:



Injection of Pyrocon E. against Red Palm Weevil, Central Coconut Research Station, Kayangulam

Entomological Laboratory, Central Coconut Research Station, Kayangulam



Plant Pathology Laboratory of the Central Coconut Research Station, Kayangulam

(a) Treatment of the breeding places of the beetle with 0.01 per cent BHC

(b) Opening of small trap pits in different parts of the coconut plantations filled with decaying cattle manure and vegetable matter having 0.1 BHC. The adult beetles are attracted for resting and oviposition and get killed

(c) Filling the central leaf axils with sand and 5 per cent BHC dust in equal proportions helps in protecting the palms from the attack of the beetle

(d) Extracting the adult beetles from the young palms by beetle rod

Control of the coconut caterpillar. (Nephantis serinopa). The attacked palms may be sprayed with 0.2 per cent DDT. The spraying may be repeated after three months, if necessary. The pest can also be controlled by releasing its natural enemies on infected palms. The Eulophid *Trichosphilus puptvora*, the Bethylid *Perisierola nephantidis,* the Elasmid *Elasmus nephantidis* and the Braconid *Microbracon brevicornis* are some of the natural enemies of the pest which are being bred in the laboratory of the Station for liberation in affected areas.

Control of the Red Palm weevil. The injection of Pycrocone E at 1 per cent strength into the affected parts of the palm was found beneficial.

Control of cock chafer. The control of the larvae of this pest, which eat away the roots of the palm, by the use of 28 lb. of 5 per cent chlordane dust per acre is effective.

Control of white ants. The use of 0.1 per cent BHC in coconut nurseries is effective.

Control of rats. Zinc phosphide and Warfarin have been found to be effective in controlling rats.

Regional Coconut Research Stations

Three regional coconut research stations to undertake cultural and manurial experiments of local significance have been set up in Kerala State by the State Government with financial aid from the Committee. The Bombay and Andhra Pradesh Governments have also set up one regional coconut research station each in their States with financial aid from the Committee. A regional coconut research station which was functioning in Orissa State since 1946 under the joint auspices of the Committee and the Orissa Government, was closed down on March 31, 1953 on account of the unsuitability of the site selected for the station. A new site for the station has since been selected and the station has started functioning again from January, 1955. The Committee has also sanctioned a scheme for the establishment of a regional coconut research station in Assam State. The station is expected to be established shortly.

Distribution of Quality Coconut Seedlings

Having regard to the fact that the coconut palm is a perennial tree which takes about eight years to start bearing and lives up to an age of about 80 years, the importance of planting quality seedlings is of the greatest importance. Realising this fact, the Committee has been financing jointly with State Governments a number of coconut nurseries since 1946 for supplying quality seedings to coconut growers. The Committee gives grant-in-aid to the tune of 50 per cent of the recurring expenditure to the State Governments for running coconut nursery schemes. The seedlings are sold at the specially low price of eight annas each ex-nursery. In addition to the Government sponsored coconut nurseries, there is a nursery attached to the Committee's Central Coconut Research Station, Kasragod, from which also quality seedlings are distributed at the same low price. There are at present 22 coconut nurseries functioning under the joint auspices of the Committee and the State Governments, with an annual production target of 3,06,500 quality seedlings.

Plant protection work

Spraying schemes. The coconut palms in the Travancore-Cochin area of Kerala State are badly affected by the root and leaf diseases. Research work done at the Committee's Central Coconut Research Station, Kayangulam, has shown that the leaf disease can be controlled by systematic spraying of the crowns of the trees three times a year with copper fungicides. The Committee has, therefore, been running, since 1948, a scheme to demonstrate the efficacy of spraying. A total number of 5,61,697 sprayings was done under the scheme till the 30th November, 1956.

Under a scheme to undertake spraying of coconut palms on a co-operative basis, the Committee had supplied to seven Co-operative Unions in Travancore-Cochin State four sprayers and hoses each, on a loan basis. The scheme was in operation from February, 1954 to the end of May, 1955 and a total number of 1,05,115 sprayings was done under it.

The Committee also gave grant-in-aid to a scheme sponsored by the Travancore-Cochin Government for spraying coconut palms in seven *taluks* of the State where the palms are lightly affected by diseases. This scheme was in operation from 1st October, 1954 to 31st May, 1955 and a total number of 96,511 sprayings was done.

In January 1956, the Travancore-Cochin Government started a unified spraying scheme covering most of the disease-affected *taluks* of the State. The Committee agreed to finance it to the tune of 50 per cent of the recurring expenditure until 31st March, 1956 after which the scheme would come under the Second Five-Year Plan. A total number of 93,153 sprayings was done under this scheme till the end of March, 1956.

PARASITE BREEDING STATIONS

Six parasite breeding stations in Kerala State and one each in Madras and Andhra State to rear and release parasites of the Nephantis pest of coconut are functioning under the joint auspices of the Committee and the respective State Governments. Of the six stations in Kerala State, one at Kasargod started functioning under the former Madras State on 4th December, 1952 and the remaining five were set up on 1st February, 1955. The Stations in Madras and Andhra States commenced functioning on the 16th November, 1955 and 1st September, 1952 respectively.

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL COCONUT COMMITTEE

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
COMPLETED SCHEMES						
Investigation of the 'Root' and 'Leaf' diseases of coconut palm	Travancore	11 years (1937-48)	0.18	To investigate the cause of 'Root' and 'Leaf' disease of coconut and to evolve control measures	Leaf disease caused by the activity of certain fungal organisms, the spores of which were disseminated through the agency of the wind. It could be controlled by spraying the crowns of the palms with copper fungicides thrice a year. Root disease might be of virus origin and its spread might be due to some insect vectors	
Research on coconuts	Madras	13½ years (1938-52)	0.14	(1) To study the performance of adult trees of the seedlings raised from nuts obtained from different types of palms by pollination (2) To study the quality and quantity of fibre obtained from coconut husks at different stages of maturity (3) To investigate into causes of button shedding	(1) Parent trees with high-yielding character alone should be selected for collection of seednuts. Progenies having higher values for morphological characters like girth at collar, number of leaves, length of leaf, etc. are capable of giving high yield (2) The husks of nuts less than 10 months old were not suitable for coir extraction as also husks from fully mature nuts. In the open system of retting, the optimum period required was about nine months. Excessive retting affected the colour of the fibre Coir yarn was best stored in shade or sea water but storing exposed to sun and rain brought rapid deterioration in quality	
Establishment of a Regional Coconut Research Station	Orissa	4½ years (1948-53)	0.23	To find out the best and most economic manurial and other agronomic practices in relation to local conditions and to solve the problems of the growers	Scheme was terminated on 31-3-1953 due to unsuitability of the site	
Coconut Nursery Scheme, Irinjalakuda	Travancore-Cochin	10 years (1946-56)	0.36	To distribute quality seedlings	83180 seedlings distributed	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL COCONUT COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Coconut Nursery Scheme, (Kazhakuttam and Vaikom)	Travancore	5 years (1946-51)	0.13	To distribute quality seedlings	23,396 quality seedlings distributed	
Coconut Nursery Scheme (Samalkot and Pattukkottai)	Madras	2 years (1946-48)	0.28	do.	14,162 seedlings distributed	
Coconut Nursery Scheme (Pattambi)	Madras	1 year (1947-48)	0.17	do.	7,613 seedlings distributed	
Coconut Nursery Scheme (Arsikere)	Mysore	6 years (1946-51)	0.11	do.	14,547 seedlings distributed	
Coconut Nursery Scheme (Coorg)	Coorg	2½ years (1949-51)	0.02	do.	820 quality seedlings distributed	
Coconut Nursery Scheme (Marudur)	Madras	4½ years (1950-54)	0.18	do.	24,562 seedlings distributed	
Development of Co-operative Marketing of Copra, Vaikom-Shertallai Society	Travancore	5 years (1946-50)	0.12	Development of marketing in copra on co-operative basis	The working of the Society was not a success	
Development of Co-operative Marketing of Copra, Narakkal Society	Cochin	5 years (1946-50)	0.09	do.	The working of the Society was not a success	
Multiplication and distribution of *Crotalaria striata* seeds	Travancore Cochin	4 months (1952)	0.01	Systematic multiplication, distribution and popularisation of the *seeds of Crotalaria striata* as a green manure crop	The crop failed due to unfavourable weather conditions	
Multiplication and distribution of *Crotalaria striata* seeds	Madras	4 years (1948-52)	0.01	do.	There was no great demand for the seeds from coconut growers	
Appointment of Coconut Propaganda Officer and Staff	Travancore-Cochin	4½ years (1951-55)	0.17	Carrying out extension service work among the coconut cultivators	Objective achieved	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL COCONUT COMMITTEE—(*Contd.*)

Namof the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Coconut development	Andamans	3 years (1953-56)	0.41	Development of coconut cultivation	Advice and information on improved methods of coconut cultivation, control of pests and diseases. etc. was given to coconut growers. Quality seedlings were also raised in the nursery for distribution to growers	
Estimation of area and yield statistics of coconuts	Mysore	5 years (1951-56)	0.14	To evolve a sampling technique for estimating as accurately as possible the area and yield of coconuts	Technique evolved	
Co-operative spraying	Travancore-Cochin	6 months (1954-55)	0.02	Spraying of coconut trees for the control of leaf disease of coconuts	1,05,115 sprayings done	
Spraying of coconut trees in highly affected taluks	Travancore-Cochin	8 months (1954-55)	0.02	do.	96,511 sprayings done	
Unified spraying Scheme	Travancore-Cochin	3 months (1956)	0.14	do.	Scheme brought under Second Five-Year Plan from 1.4.1956	
			CURRENT SCHEMES			
Establishment of Regional Coconut Research Station	Kerala	11 years (1947-58)	2.28	To undertake research on cultural and manurial aspects of coconut cultivation on a regional basis		Scheme current
Establishment of Regional Coconut Research Station	Andhra Pradesh	5 years (1955-60)	0.41	do.		do.
Establishment of Regional Coconut Research Station	Orissa	6 years (1955-61)	1.14	do.		do.
Establishment of Regional Coconut Research Station	Bombay	5 years (1955-60)	0.59	do.		do.
Establishment of Regional Coconut Research Station	Assam	5 years (1957-61)	0.51	do.		do.

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL COCONUT COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Investigation of Band disease of coconut palm	Maharashtra Association for the cultivation of Science, Poona	5 years (1955-60)	0.36	To determine the cause of disease and to find out a suitable remedy for it		
Expansion of coconut nursery work	Kerala	10 years (1951-61)	4.13	To distribute quality seedlings	3,74,466 seedlings distributed up to June, 1956	
Coconut Nurseries at Nileshwar and Badagara	Kerala	2 years (1956-58)	—	do.	Nursery functioning	
Coconut Nursery, Ollukkara	Kerala	5 years (1954-59)	0.08	do.	3182 seedlings distributed up to June, 1956	
Coconut nursery, Wadakkancherry	Kerala	5 years (1955-60)	0.10	do.	1,210 seedlings distributed up to June, 1956	
Comprehensive Coconut Nursery Scheme	Madras	10 years (1948-58)	4.62	do.	8,14,113 seedlings distributed up to June, 1956	
Coconut Nursery, Hebbal	Mysore	5 years (1951-56)	0.37	do.	51810 seedlings distributed up to June, 1956	
Comprehensive Coconut Nursery Scheme	Andhra Pradesh	3½ years (1953-57)	0.46	do.	1,12,227 seedlings distributed up to June, 1956	
Coconut Nursery Scheme, Kumta	Mysore	10 years (1948-58)	0.48	do.	51,647 seedlings distributed up to June, 1956	
Coconut Nursery Scheme, Nandgaon	Bombay	5½ years (1950-56)	0.46	do.	8 997 seedlings distributed up to June, 1956	
Coconut Nursery Scheme, Chandernagore	West Bengal	10 years (1951-61)	1.34	do.	46544 seedlings distributed up to June, 1956	
Coconut Nursery Scheme, Cooch Bihar	West Bengal	5 years (1954-59)	0.17	do.	2625 seedlings distributed up to June, 1956	
Coconut Nursery Scheme	Orissa	10½ years (1956-57)	0.85	do.	117252 seedlings sold up to June. 1956. Scheme being extended	
Coconut Nursery Scheme, Kahikuchi	Assam	5 years (1951-56)	0.21	do.	Scheme being continued under the Second Five-Year Plan	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL COCONUT COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Establishment of parasite breeding stations for control of coconut caterpillar pest	Kerala	3 years (1955-58)	0.18	To rear in large numbers parasite of the coconut caterpillar and to systematically liberate them in regions affected by the pest with a view to keep the pest under control	1100421 parasites liberated up to June 1956. One of the 5 stations set up under the Scheme passed on to the Madras State from 1-11-1956	
Establishment of a parasite breeding station for biological control of *Nephantis serinopa*	Kerala	4 years (1952-56)	0.10	To intensify the biological method of control of *N. serinopa* by breeding and liberating in the affected areas parasites of the pest	Two parasites of the pest, viz Eulophid and Bethlid were reared and liberated wherever infestation of the pest was noticed. Release of the parasites had an appreciable effect in reducing infestation	
Establishment of a parasite breeding station for biological control of *Nephantis serinopa*	Madras	6 months (1955-56)	0.02	do.	7400 Eulophids and 640 Bethlids liberated during the period	
Establishment of a parasite breeding station for biological control of *Nephantis serinopa*	Andhra Pradesh	4 years (1952-56)	0.13	do.	Parasites multiplied and liberated	
Coconut Development Scheme	W. Bengal	5 years (1952-57)	0.38	To develop coconut cultivation n the State in all its aspects	Scheme being run successfully	
Organising a co-operative Marketing Society for coconut growers	Kerala	1 year (1956)	0.03	To afford better facilities to coconut growers of Kasargod taluk for marketing their coconuts and for improving their economic condition	No definite results reported so far. Scheme was in Madras State up to 31-10-56	
Maintenance of a collection Block of representative varieties of coconuts	Assam	5 years (1954-58)	0.03	To establish a coconut plantation of representative varieties and to study their performance under conditions obtaining in Assam	Seedlings of different varieties of the coconut palm obtained and planted in the collection block	

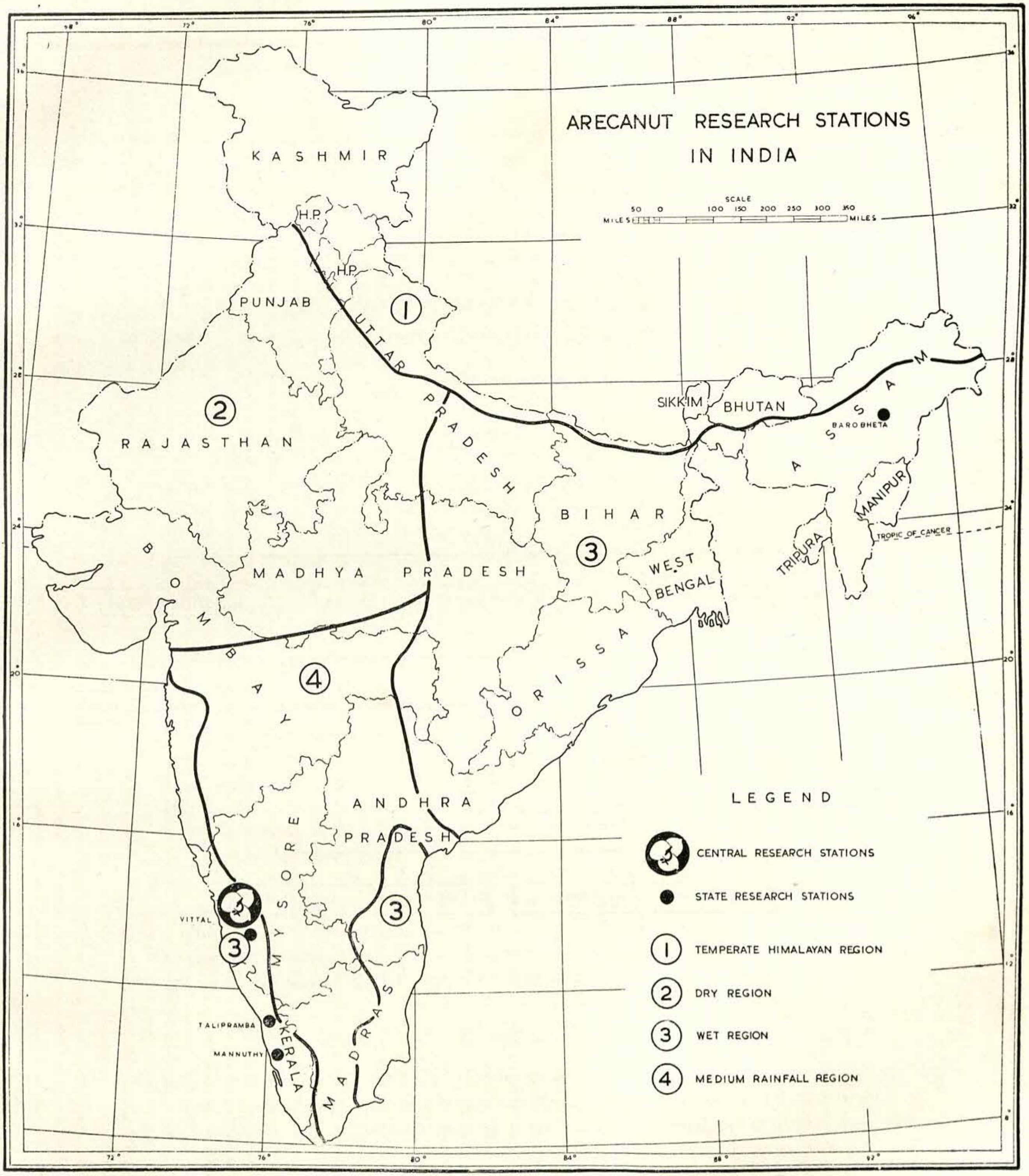
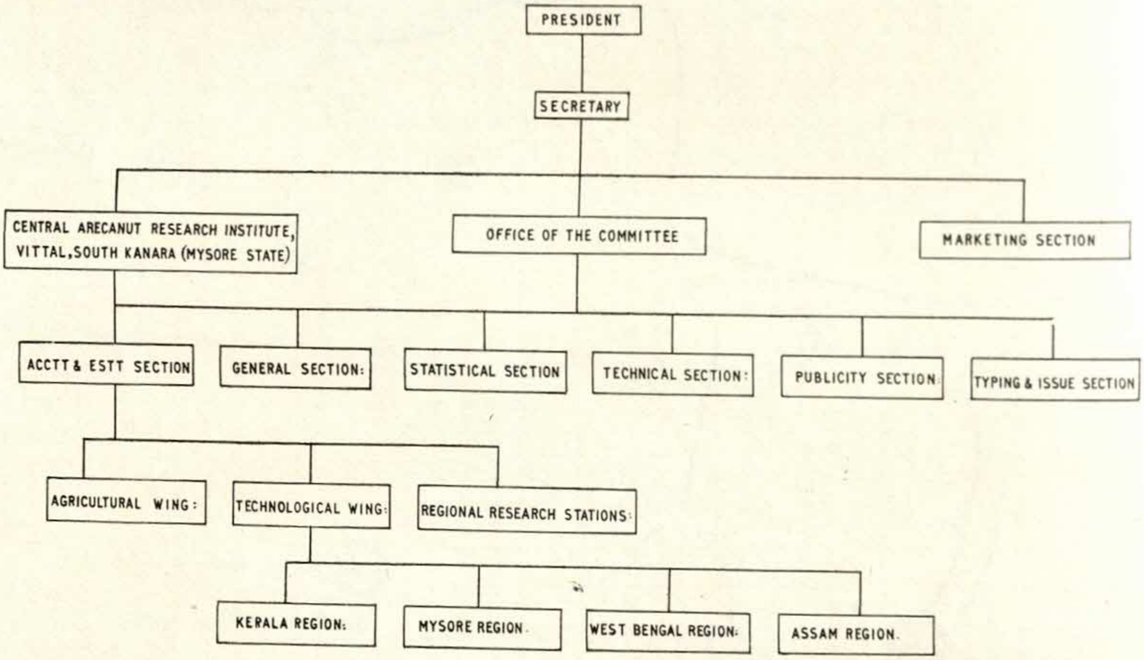

ARECANUT RESEARCH STATIONS IN INDIA
SCALE
50 0 100 150 200 250 300 350
MILES
MILES
KASHMIR
H.P.
H.P.
PUNJAB
UTTAR PRADESH
RAJASTHAN
SIKKIM
BHUTAN
ASSAM
BAROBHETA
MANIPUR
TRIPURA
TROPIC OF CANCER
BIHAR
WEST BENGAL
MADHYA PRADESH
BOMBAY
ORISSA
ANDHRA PRADESH
MYSORE
MADRAS
KERALA
VITTAL
TALIPRAMBA
MANNUTHY
①
②
③
③
③
④
LEGEND
CENTRAL RESEARCH STATIONS
● STATE RESEARCH STATIONS
① TEMPERATE HIMALAYAN REGION
② DRY REGION
③ WET REGION
④ MEDIUM RAINFALL REGION
68°
72°
76°
80°
84°
88°
92°
96°
36°
32°
28°
24°
20°
16°
12°
8°

PLATE L]

INDIAN CENTRAL ARECANUT COMMITTEE

Headquarters—Kozikhode (Kerala)

Organisation Chart



INDIAN CENTRAL ARECANUT COMMITTEE

Headquarters—Kozhikode (Kerala State)

ARECANUT industry in India was passing through a crisis when the Second World War ended in 1945. Representation was made to the Government of India that this important crop was neglected and required attention of the Government. The possibilities of heavy imports of arecanut from foreign countries and their effect on the local price were also impressed on the Government. Some control was demanded with a view to regulate the marketing of local and imported nuts. The Government of India, therefore, set up an *ad hoc* Committee under the Indian Council of Agricultural Research to consider preliminary measures for effecting improvements in the arecanut industry, and to formulate a co-ordinated scheme for the purpose. On the recommendation of the *ad hoc* Committee, the Government of India constituted the Indian Central Arecanut Committee in May, 1949. The headquarters of the Committee are located at Kozhikode (Calicut) in Kerala.

ORGANISATION

President of the Committee nominated by the Central Government

Agricultural Commissioner with the Government of India

Agricultural Marketing Adviser to the Government of India

Additional Agricultural Commissioner with the Government of India

Two representatives of the Ministry of Finance (one from the Revenue Division and the other from the Expenditure Division) to be nominated by the Central Government

A representative of the Ministry of Commerce and Consumers Industries to be nominated by the Central Government

Four members, to represent consumers, of whom three shall be elected from among themselves by the members of the Lok Sabha and one shall be elected from among themselves by the members of the Rajya Sabha

Sixteen persons representing the growers of arecanut in India, of whom six shall be nominated by the Government of Kerala, five by the Government of Mysore, two by the Government of Assam and one each by the Governments of Madras, Bombay and West Bengal

Eight persons representing the Departments of Agriculture respectively of Madras, Bombay, West Bengal, Assam, Mysore, Andhra, Kerala and Orissa appointed in each case by the Government concerned

Seven persons representing the trade in arecanut, one each being nominated by the Governments of Madras, Mysore, Kerala, the All India Supari (betelnut) Federation, the Federation of the Indian Chambers of Commerce, the Palghat Chamber of Commerce and the Kanara Chamber of Commerce

Such other persons as the Central Government may from time to time appoint.

FUNCTION

To assist the Government in the improvement and development of the production and marketing of arecanut and arecanut products and all matters incidental thereto by

(i) undertaking, assisting or encouraging agricultural, industrial, technological and economic research,

(ii) producing, testing and distributing improved varieties of seed,

(iii) encouraging and assisting the adoption of improved methods in cultivation so as to increase yield and improve quality,

(iv) assisting in the control of parasites and insect pests and fungal diseases which affect arecanut in the field, in storage or during transport,

(v) carrying on such propaganda in the interest of the arecanut industry as may be necessary,

(vi) encouraging the adoption of improved measures for the marketing of arecanut, fixing and adoption of grade standards for arecanut and its products,

(vii) encouraging the purchase, curing, grading and marketing of arecanut and its products through co-operative or other agencies and undertaking enquiries and making recommendations relating to storage transport facilities, etc.,

(viii) giving financial and technical assistance to organisations engaged in growing, curing, processing, grading, marketing and manufacture of arecanut and its products,

(ix) maintaining such institutes, farms, stations, curing arrangements, ware-houses, conditioning and processing plants as may be necessary,

(x) collecting statistics from growers, traders and manufacturers on all relevant matters connected with arecanut and distribution of such statistics and information to the interests concerned, and establish a Market Intelligence Service,

(xi) making advice available on all matters essential to the development of the arecanut industry and advising on such matters as fall within the functions of the Committee which are referred to it by the Government,

(xii) employing such staff as may be necessary for the proper performance of any or all of these functions, and

(xiii) recommending the maximum and minimum prices to be fixed for arecanut, and the controlled purchase and distribution of imported arecanut, and adopting any other measures or performing any other duties which may be required by the Government of India to adopt or perform or which the Committee may consider necessary or advisable in order to carry out the purposes for which it is constituted.

FINANCE

The funds of the Committee are derived from the annual grant to the extent of expenditure but not exceeding Rs. 5 lakhs made by the Government of India.

The income is spent for the improvement of arecanut industry, in the field of research, development and marketing.

Pattern of assistance

The entire non-recurring, and 50 per cent of recurring expenditure on the schemes is met by the participant State Government, and the Committee meets the other 50 per cent of the recurring expenditure.

The receipts are normally shared by the State Government and the Committee on 60 :40 basis respectively.

SCHEMES

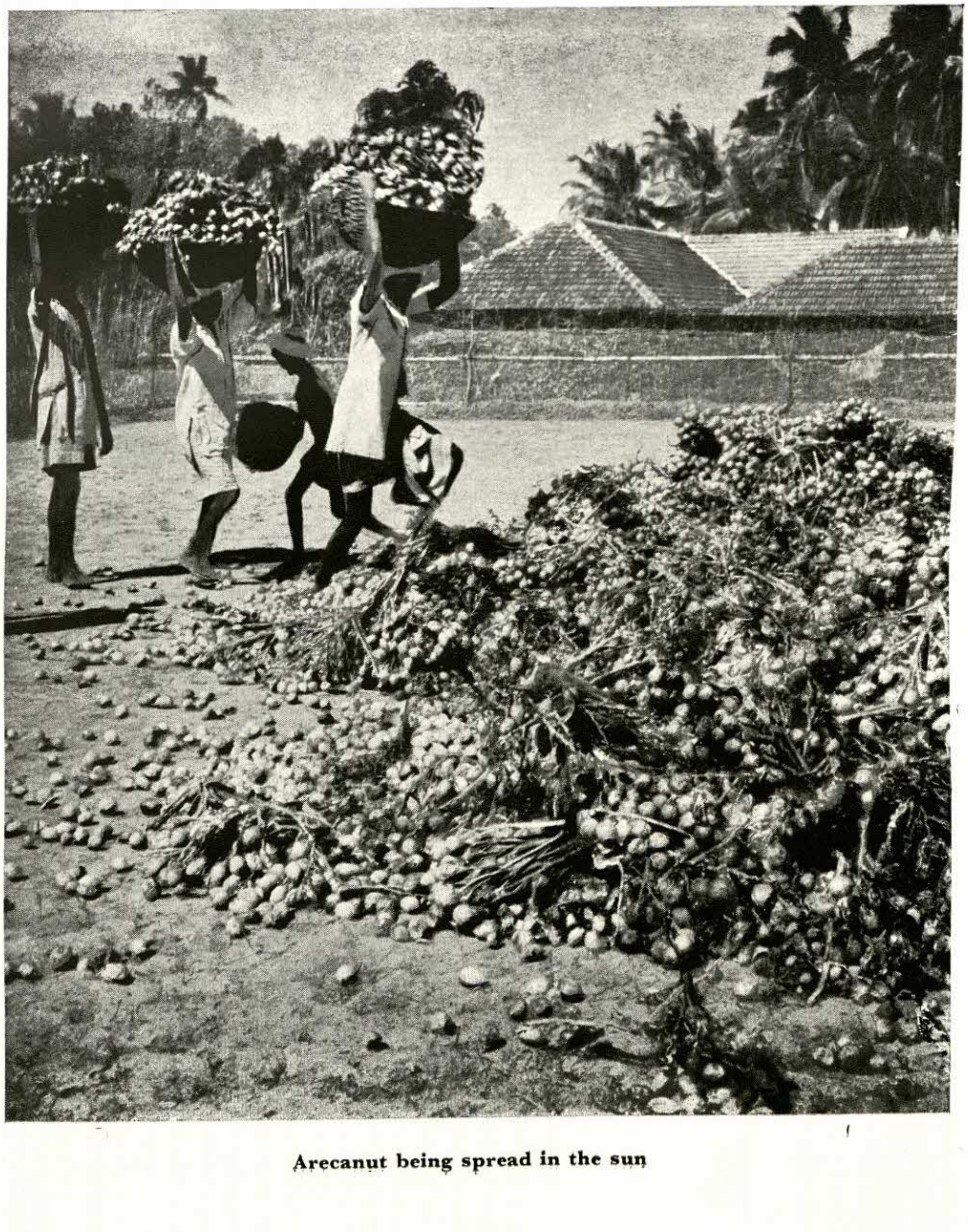
I. Research

(a) Fundamental research	Central Arecanut Research Station, Vittal (Mysore)
(b) Regional research	Regional Research Stations

Arecanut and banana mixed plantation, Mysore

Fruits of arecanut

Transplanting arecanut seedlings



Arecanut being spread in the sun

(c) Technological research	University schemes and research at the Arecanut Technological Wing
(d) Manuring scheme	
(e) Disease investigation schemes	
II. **Development schemes**	Nursery schemes
III. **Statistical schemes**	1. Cost of arecanut cultivation scheme 2. Statistics of area and production of arecanut
IV. **Marketing schemes**	1. Marketing survey 2. Organisation of co-operative marketing societies

ACHIEVEMENTS

Arecanut is a perennial crop which takes about 8 to 10 years to bear fruit, and tangible results can be obtained only after research is spread over a period of years.

The first stage of the investigation of the stem-breaking disease of areca palm is over, and it has been established that the disease is due to the sun scorch on the tender stem. Investigation on band disease in Bombay State is progressing well.

Though no conclusive results have been obtained so far, the observations show that the disease might be due not only to physiological or nutritional disorders or want of proper drainage facilities but also due to faulty methods of irrigation, manuring and cultivation.

Agronomical and manurial experiments have been laid out at the Regional Arecanut Research Station, Thirthahalli and only one year's data is available at present. The standardisation of fungicidal spray has also been attempted.

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL ARECANUT COMMITTEE

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Extension Service Scheme, (fruit rot) Anti -Mahali Campaign	Travancore-Cochin and the Malnad region of erstwhile Mysore	1½ years (1950-52)	0.20	To educate areca growers on spraying methods against *Mahali* (*Phytopthora arecae*) cultural practices and seednut selection work	Modern anti- Mahali measures were organised in Kerala and Mysore regions	
Investigations on alkaloidal and other content in various parts of arecanut palm	Madras University	1 year (1951-52)	0.03	To assess the tannin content in the arecanut fruit and to examine possibilities of obtaining steroids from the fat of arecanut	6-22 per cent tannin found in ripe arecanuts Beta sita sterol could be isolated from arecanut fat	
Investigation of stem-breaking disease of areca palm	Madras	3 years (1952-55)	0.05	To trace the causes for stem-breaking in the areca palm and to suggest remedial measures	Proper wrapping and shading against sun-scald recommended	
Survey of waste lands suitable for arecanut cultivation	West Bengal, Assam, Bombay, Mysore, Madras	6 months (1954)	0.05	To assess the suitability of waste lands in certain States for cultivation of arecanut	38,000 acres found fit for expansion of areca and connected crops	
Collect on of statistics of area under and production of arecanut	West Bengal	8 months (1953-54)		To estimate the area and production of arecanut in West Bengal State	Survey report issued	
Collection of statistics of area under the production of arecanut	Mysore	1¾ years (1953-55)		To estimate area and production of arecanut in Mysore State	Survey report issued	
Analysis of sliced and boiled arecanuts with a view to drawing up of grade specifications	Madras	1 year (1955-56)	0.03	To collect 250 good samples of sliced and boiled arecanuts from important markets in India and to analyse the samples for fixation of grade specifications under Agmark	Analysis completed	
Raising and distributing quality seedlings to areca growers in rehabilitation areas	I.C.A.C	1¾ years (1954-56)	0.07	To raise an arecanut nursery with 50,000 seedlings for distribution to growers in rehabilitation areas of North Malabar	41937 seedlings were raised and distributed	
Establishment of an arecanut research station	Mysore	10 years (1952-62)	1.94	Research development and disease control work. Also to establish a Regional Meteorological observatory	13 acres areca garden laid out for experimental purposes , 2 acres of new planting with cultural experiments completed	Scheme current

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL ARECANUT COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Establishment of an arecanut research station	Kerala	5 years (1952-57)	0.43	To conduct researches on arecanut on regional basis	Progress of work hampered due to paucity of water	Closed on 16-10-1957
Investigation and control of diseases in areca palm	Bombay	5 years (1953-58)	0.39	To investigate into the causal factors for the incidence of Band disease of areca palm and to determine remedial measures	Successful fruit bearing achieved in affected palms treated with copper sulphate	Scheme current
Investigation and control of diseases in areca palm	Maharashtra Association for the cultivation of Science, Poona	3½ years (1954-58)	Lump sum grant of about Rs. 5000/- p.a.	To investigate into the causal factors for the incidence of Band disease of areca palm and to determine remedial measures	do.	To terminate on 31-5-58
Investigation and control of diseases in areca palm	Mysore	5 years (1956-61)	0.23	To find out the causes of the 'Hidimundige' disease and suggest remedial measures	—	Scheme current
Investigation of the better uses of bye-products of arecanut	Gauhati University	6 years (1952-58)	0.35	Better utilisation of bye-products of arecanut (husk and *kali*)	Wool and insulation board prepared from husk, ink manufactured from the tender arecanut and mosquitocidal properties found in *kali*	do.
Investigation of the better uses of bye-products of arecanut	C.L.R.I., Madras	1 year (1956-57)	0.07	Trials regarding tanning properties of arecanut and *kali*		do.
Investigation of the better uses of bye-products of arecanut	Muslim University, Aligarh	2 years and 2 months (1955-58)	0.04	Trials regarding tanning properties of arecanut and *kali*		do.
Investigation of the better uses of bye-products of arecanut	Andhra University	2 years (1955-57)	0.09	Better utilisation of bye-products of arecanut		do.
Investigation of the better uses of bye-products of arecanut	F.R.I., Dehra Dun	3 years (1956-59)	0.20	Better utilisation of bye-products of arecanut		do.

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL ARECANUT COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Distribution of seedlings	Assam	10 years (1951-61)	0.68	Raising 60,000 seedlings for distribution to arecanut growers (Jorhat Nursery)		Scheme current
Distribution of seedlings	W. Bengal	10 years (1951-61)	0.87	Raising 60,000 seedlings for distribution to arecanut growers (Krishnagar Nursery)		do.
Distribution of seedlings	W. Bengal	6 years (1953-59)	0.74	Raising 45,000 seedlings for distribution to arecanut growers (Maynaguri Nursery).		do.
Distribution of seedlings	W. Bengal	6 years (1953-59)		Raising 15,000 seedlings for distribution to arecanut growers (Cooch Bihar nursery)		
Distribution of seedlings	Andhra Pradesh	5 years (1956-61)	1.47	Raising 9 lakh seedlings for distribution to arecanut growers		do.
Establishment of a Central Arecanut Research Station, Vittal	Mysore	10 years (1956-66)	5.38	To undertake researches on fundamental problems of arecanut		do.

INDIAN CENTRAL OILSEEDS COMMITTEE

Headquarters—Hyderabad (Andhra Pradesh)

THE Indian Central Oilseeds Committee was constituted in May, 1947 under the Indian Oilseeds Committee Act No. IX of 1946. The Committee has its headquarters at Hyderabad, the capital of Andhra Pradesh which is the main castor and groundnut growing area. The Committee is financed from funds derived from an excise duty at the rate of one anna per maund on all oils extracted from oilseeds in any power mill in India, and a custom duty at the rate of two annas per maund on all oilseeds exported out of India. These funds enable the Committee to undertake improvement and development of the cultivation and marketing of oilseeds and of the production, manufacture and marketing of oilseed products in India.

The Committee is represented by various interests such as the Central Government, the State Departments of Agriculture, oilseeds growers, co-operative movement, Oil Technologists' Association, village oil industry, *vanaspati* industry, power oil industry, exporters of oils and their products. The total membership of the Committee at present is 59.

Under Section 7 of the Indian Oilseeds Committee Act, 1946, the Central Government may appoint persons to be the President and the Secretary of the Committee. The Vice-President is elected by the Committee every year. Under Section 18 of the Indian Oilseeds Committee Act, the Committee has powers to appoint a Standing Finance Sub-Committee and other Sub-Committees and also delegate any powers to them exercisable under this Act by the Committee. The following Sub-Committees have been constituted:

(1) Standing Finance Sub-Committee
(2) Agricultural Research Sub-Committee
(3) Technological Research Sub-Committee
(4) Marketing Sub-Committee
(5) Village Oil Industry Sub-Committee
(6) Appointments Sub-Committee

FINANCE

The total receipts of the Committee since its inception in 1947 up to the 31st March 1955 amounted to Rs. 1,35,15,171 out of which Rs. 1,24,00,051 represent collections from cess under Section 3 (2) of the Indian Oilseeds Committee Act, 1946. The receipts of cess from oils and oilseeds during the year 1955-56 amounted to Rs. 21,23,220 as against Rs. 15,21,649 in the previous year. The expenditure during the year 1955-56 was Rs. 8,75,325 as against Rs. 9,35,986 in the previous year, excluding " debt heads ".

Pattern of financial assistance

Agricultural research schemes may be financed in full up to a period of 10 years, subject to review at the end of third, fifth and eighth years. To justify further help from the Committee after this period, special technical or scientific reasons are necessary, particularly if the Committee's share is to exceed 50 per cent of the total expenditure to which it will normally be limited. The non-recurring expenditure in respect of agricultural research schemes submitted by the State Governments will not ordinarily be borne by the Committee.

Non-recurring expenditure in respect of technological research schemes will not ordinarily be borne by the Committee. The net recurring expenditure on such schemes may be financed in full up to a period of three years. To justify further financial help from the Committee after this period, special technical or scientific reasons are necessary, particularly if the Committee's share of expenditure is to exceed 50 per cent of the net recurring expenditure to which it will normally be limited.

Technological schemes for pilot plant scale investigations of the results of laboratory research may be financed entirely by the Committee for a period of three years.

In the case of schemes not falling within the above categories, the Committee's share of expenditure will be limited to 50 per cent of the net recurring expenditure except in very special cases.

Expenditure on seed multiplication and/or distribution schemes will be divided into (a) cost of staff, and (b) incidental charges on the distribution of seed of approved varieties, less receipts, if any. The Committee shall bear either the cost of staff or the incidental expenditure, but not both. The bigger share of expenditure, however, will not necessarily be borne by the Committee.

Seed schemes will be sanctioned for periods not exceeding five years in the first instance, but they may be extended subsequently for a further period of five years on the condition that (a) the Committee's share of expenditure in the second period will not exceed 75 per cent, either of the pay of the staff or incidental expenditure, and (b) that the State Government concerned will contribute not less than the sum spent during the original period of the scheme. It is not necessary, however, that the grant for the renewal period should be less than for the first sanctioned period, but the Committee's contribution will not exceed 75 per cent.

After a seed distribution scheme has been in operation for a period of ten years, the contribution of the Committee during the next five years will be limited to 33 per cent of the cost of the staff or incidental expenses, subject to a maximum of 15 per cent of the total cost of the scheme during the extension period.

ACHIEVEMENTS

The Committee has since its inception in 1947, been financing schemes on agricultural, industrial, technological and economic research on the major oilseeds and their products. Schemes for the evolution of improved varieties of oilseed crops possessing high yield and better quality have been financed. Schemes for the multiplication and distribution of seeds of such improved varieties to the cultivators in the major oilseeds growing States of the Indian Union have also been financed. Schemes for promoting the improvement of marketing of oilseeds and their products and the adoption of grade standards are also in progress. This Committee has so far financed 34 research schemes at a cost of about 18 lakhs of rupees and 14 developmental schemes at a cost of 7 lakhs of rupees.

At its first meeting held in October 1947, the Committee decided that steps should be taken to develop the village oil industry in India and constituted a standing Sub-Committee for the purpose. Further, schemes for promoting the co-operative movement in village oil industry were also financed. The measures adopted in this direction were : (i) organisation of Village Co-operative Societies of Oilmen, (ii) grant of interest-free loans to Village Co-operative Societies of Oilmen, (iii) subsidising the loss incurred by Village Co-operative Societies through fluctuation in prices of oilseeds and (iv) training in village oil industry. A sum of nearly 10 lakhs of rupees has been spent by the Committee in financing schemes of village oil industry.

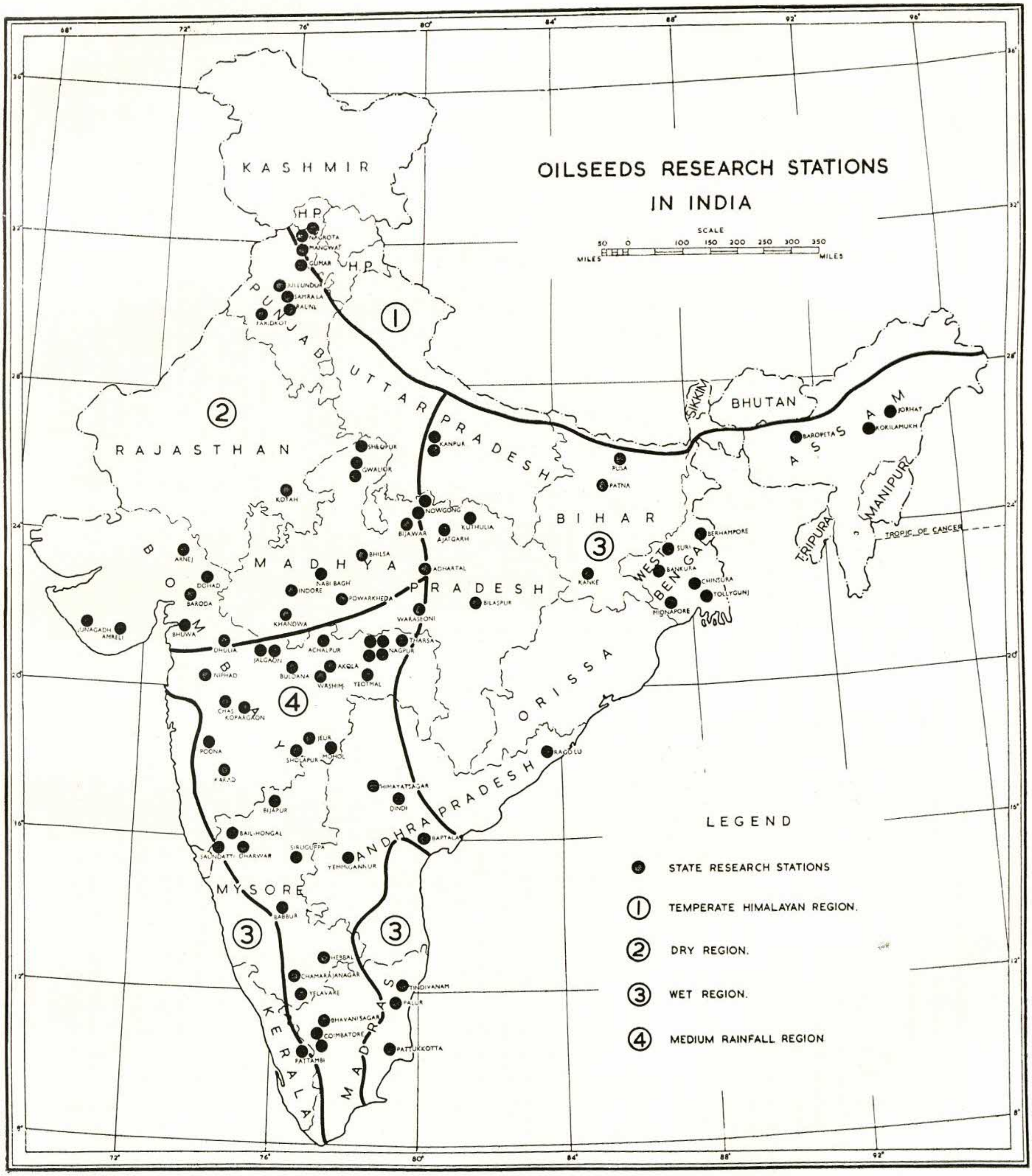
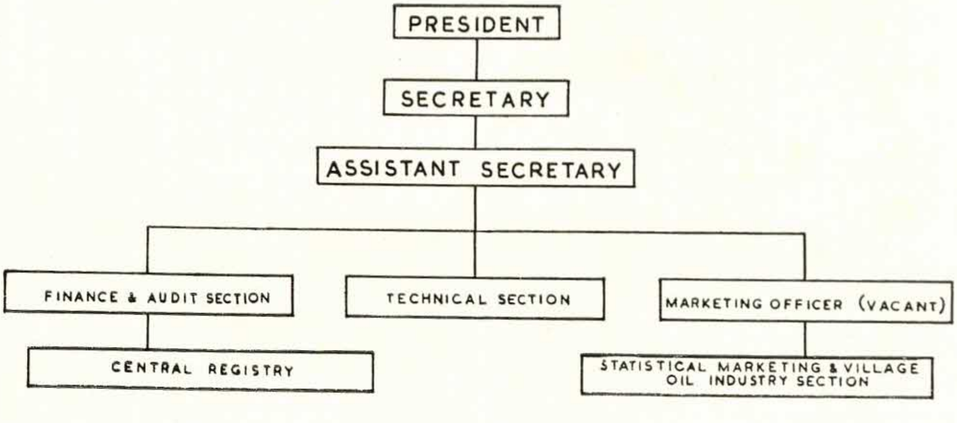

OILSEEDS RESEARCH STATIONS IN INDIA
SCALE
50 0 100 150 200 250 300 350
MILES
MILES
LEGEND
● STATE RESEARCH STATIONS
① TEMPERATE HIMALAYAN REGION.
② DRY REGION.
③ WET REGION.
④ MEDIUM RAINFALL REGION
KASHMIR
H.P.
PUNJAB
UTTAR PRADESH
RAJASTHAN
BOMBAY
MADHYA PRADESH
BIHAR
WEST BENGAL
ORISSA
ANDHRA PRADESH
MYSORE
KERALA
MADRAS
ASSAM
BHUTAN
SIKKIM
TRIPURA
MANIPUR
TROPIC OF CANCER
①
②
③
④
NAGROTA
MANGWAT
GUMAR
JULLUNDUR
SAMRALA
PALNI
FARIDKOT
SHEOPUR
GWALIOR
KOTAH
KANPUR
NOWGONG
BIJAWAR
AJAIGARH
KUTHULIA
BHILSA
NABI BAGH
INDORE
POWARKHEDA
KHANDWA
ADHARTAL
WARASEONI
BILASPUR
ARNEJ
DOHAD
BARODA
JUNAGADH
AMRELI
BHUWA
DHULIA
JALGAON
ACHALPUR
AKOLA
BULDANA
WASHIM
YEOTMAL
THARSA
NAGPUR
NIPHAD
CHAS
KOPARGAON
POONA
KARAD
JEUR
SHOLAPUR
MOHOL
HIMAYATSAGAR
DINDI
BIJAPUR
BAIL-HONGAL
SAUNDATTI
DHARWAR
SIRUGUPPA
YEMMIGANUR
BAPTALA
BABBUR
HEBBAL
CHAMARAJANAGAR
YELAVARE
BHAVANISAGAR
COIMBATORE
PATTAMBI
TINDIVANAM
PALUR
PATTUKKOTTA
RAGOLU
PUSA
PATNA
KANKE
SURI
BANKURA
BERHAMPORE
CHINSURA
TOLLYGUNJ
MIDNAPORE
BAROPETA
JORHAT
KOKILAMUKH
68°
72°
76°
80°
84°
88°
92°
96°
36°
32°
28°
24°
20°
16°
12°
8°

PLATE LV

INDIAN CENTRAL OILSEEDS COMMITTEE

Headquarters—Hyderabad (Andhra)

Organisation Chart



RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL OILSEEDS COMMITTEE

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
			(COMPLETED)			
Evolving breeding technique for castor	Andhra Pradesh	5 years (1951-56)	0.06	To evolve a breeding technique for self sterile castor	Objective achieved	
Improvement of castor	Andhra Pradesh	16 years (1934-50)	0.14	To evolve high yielding and high oil content strains of castor	—	Upto 1947 the scheme was financed by I.C.A.R.
Research on pests of safflower	Bombay	5 years (1945-50)	0.15	To study the pests of safflower with respect to their bionomics and control	Objective achieved	
Multiplication of improved strains of groundnut	Bombay	5 years (1952-57)	0.03	do.	do.	
Multiplication of improved strains of groundnut	Bombay (Saurashtra)	5 years (1952-57)	0.33	do.	do.	
Multiplication of improved strains of groundnut	Madras	8 years (1943-51)	0.01	do.	do.	Amalgamated with the scheme for running zonal nucleus seed farms
Trials of insecticides for the *Surul* pest and fungicides for *tikka* leaf spot diseases of groundnut crop	Travancore	2 years (1951-53)	0.06	To carry out large scale trials with DDT 5 per cent and Bordeaux mixture ¾ per cent and sulphur against '*Surul*' pest and *Tikka* disease respectively		
Manufacture of a small solvent extraction plant	Uttar Pradesh	6 months (1949-50)	0.18	To design and manufacture a small solvent extraction plant useful for installation in small places	Report awaited	
Pests of linseed	Madhya Pradesh	6 years (1943-47 and 1950-52)	0.20	To study the life history, seasonal history and behaviour of the pests, critical survey of the host plants of the pests and investigations into factors responsible for serious outbreaks		

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL OILSEEDS COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Multiplication of improved strains of groundnut and linseed	Bhopal	2 years (1954-56)	0.17	To multiply and distribute improved strains of groundnut	—	
Groundnut breeding	Mysore	8 years (1944-52)	0.12	To replace the local commercial varieties under cultivation by improved ones with high yield, high oil content, better shelling out-turn-resistance to drought and disease and a greater adaptability to varying conditions of soil and climate	—	The scheme taken over from I.C.A.R. in 1948
Multiplication of groundnut	Punjab	5 years (1952-57)	0.03	To multiply and distribute pure seeds of improved strains of groundnut	—	
Research on pests and diseases, of *til* and other oilseeds	Uttar Pradesh	8 years (1943-51)	0.18	To find out remedies for the damage caused by some of the major pests and diseases of *til* and mustard crops	—	Scheme taken over from I.C.A.R.
Investigation on linseed rust	Uttar Pradesh	5 years (1952-57)	0.36	To investigate the linseed rust together with its control measures	—	
Survey and collection of Kamala seeds (*Mallotus phillippensis*)	Bihar	6 months (1955)	0.03	To carry out a survey of kamala seeds in Bihar	There is no market for the seeds	
Manufacture of a small hand-filter press	Uttar Pradesh	4 months (1950)	0.02	Designing and manufacturing of a filter press suitable for use in villages which can be worked by hand	A small hand worked filter press suitable for cottage oil industry was designed and manufactured	
Manufacture of machinery for processing *neem* fruit	Uttar Pradesh	4 years (1953-57)	0.17	To design and manufacture suitable machinery for drying, depulping and decorticating *neem* fruit so as to produce good quality oil	Report awaited	
Scheme regarding oil from wild *Cassia* varieties	Muslim University, Aligarh	1 year (1952-53)	0.05	Extraction and characterisation of oil from the seeds of various weeds of *Cassia* varieties and possibilities of their utilisation	Oils from *Cassia* varieties were examined for their chemical and physical characteristics and chrysophanic acid was isolated in pure form	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL OILSEEDS COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Investigations on reclamation of rancid food fats, etc.	Calcutta University	2 years (1953-55)	0.08	To find out a method of refining so as to reclaim and recondition rancid edible fats like the oils of sesame, groundnut, mustard and also edible animal fats	A method of reclamation of rancid cow ghee evolved	
Identification of different vegetable oils	N.C.L., Poona	3 years (1953-56)	0.20	Investigations on different methods of identification of vegetable oils	Methods were developed for identification and estimation of adulteration in rape, mustard, castor and linseed oils	
Utilisation of Kamala and other less known oils in paints and varnishes	N.C.L., Poona	2 years (1954-56)	0.12	Investigations on utilisation of Kamala oil, tobacco-seed oil and other less known oils in the manufacture of paints and varnishes	Report awaited	
Determining the quantity of oil in small samples of oilseeds	I.A.R.I.	4 years (1952-56)	0.18	Determination of iodine value and depth of colour of oil by using small samples of oilseeds	Methods were developed for rapid estimation of yield, iodine value and tocopherol content of oils in small samples of oilseeds. A method for estimation of saturated acid content in small quantities of oils was also evolved	
Development of anti-oxidants for edible oils	I.A.R.I.	2 years (1954-56)	0.11	To extract, identify and utilise the antioxidant principles present in certain desert plants for preservation of edible oils	Phenobic extracts from *Myristica malabarica* gave enough stability to *vanaspati*, ghee and lard even in 1% concentration	
Investigation into the nutritive value of different oilcakes produced by *ghani*, expeller and solvent extraction process	I.V.R.I.	6 years (1950-56)	2.63	(1) To determine the comparative nutritive value of (*i*) common oilcakes produced by *ghani* expeller and solvent extraction and (*ii*) cotton seed and cotton-seed cake	Report awaited	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL OILSEEDS COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Survey of minor oilseeds	Madras	1 year (1949-50)	0.08	To conduct an economic survey (botanical and chemical) of all oil bearing plants and seeds in India	Objective achieved	
Survey of minor oilseeds	Bhopal	1½ years (1952-54)	0.12	do.	do.	
Survey of minor oilseeds	Madhya Bharat	1½ years (1953-55)	0.06	do.	do.	
Survey of minor oilseeds	Mysore	6 months (1954)	0.03	do.	do.	
Survey of minor oilseeds	Vindhya Pradesh	1 year (1953-54)	0.03	do.	do.	
Survey of minor oilseeds	Travancore-Cochin	1 year (1954-55)	0.01	do.	do.	
Survey of minor oilseeds	Hyderabad	2 years (1954-56)	0.13	do.	do.	
Drawing up of grade specifications for vegetable oils	—	1½ years (1949-51)	0.96	To lay down grade standards for mustard oil, groundnut oil, castor oil, linseed oil, sesamum oil, cottonseed oil, *mahua* oil, safflowar oil, nigerseed oil and *neem* oil	do.	
Setting up of chemical laboratories at ports for analysis of vegetable oils	—	6 months (1950)	0.05	To explore the possibility of establishing chemical laboratories at ports for analysing vegetable oils meant for export	—	
Revising the report on marketing of linseed in India	—	1½ years (1953-55)	0.23	To incorporate information on up-to-date data reproduction, utilisation, prices, etc.	Objective achieved	
Pilot scheme for conducting crop cutting experiments on oilseed crops	Madras	2 years (1951-53)	0.17	To examine the modifications required in the current sampling techniques for surveys on food crops	do.	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL OILSEEDS COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Pilot scheme for conducting crop cutting experiments on oilseed crops	Madhya Pradesh	2 years (1951-53)	0.04	To examine the modifications required in the current sampling techniques for surveys on food crops	Objective achieved	
Pilot scheme for conducting crop cutting experiments on oilseed crops	Uttar Pradesh	2 years (1952-54)	0.08	do.	do.	
Pilot scheme for conducting crop cutting experiments on oilseed crops	Vindhya Pradesh	1 year (1954-55)	0.01	do.	do.	
Pilot scheme for conducting crop cutting experiments on oilseed crops	Rajasthan	2 years (1953-55)	0.06	do.	do.	
Pilot scheme for the estimation of cost of production of cotton and rotation crops	Madhya Pradesh	1 year (1952-53)	0.26	To evolve a suitable sampling and operational technique	do.	
			CURRENT SCHEMES			
Research on the physiology of groundnut and sesamum	Central Tobacco Committee	5 years (1953-58)	0.46	To study— (*i*) Physiology of pod formation and dormancy in different varieties of groundnut (*ii*) Deficiency symptoms and nutritional requirements in sesamum	—	
Improvement of oilseed crops	Andhra Pradesh	4 years (1954-58)	1.47	To evolve superior strains of groundnut, castor and sesamum through breeding	—	
Research on pests and diseases of castor and other oilseeds	Andhra Pradesh	6 years (1951-57)	0.74	To conduct large scale trials both in the laboratory and in field for the control of castor and other oilseed pests	—	
Zonal nucleus seed farms of improved strains of groundnut and castor	Andhra Pradesh	9 years (1951-60)	0.80	To multiply seeds of groundnut and castor for distribution among the cultivators	—	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL OILSEEDS COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Multiplication and distribution of improved castor seeds	Andhra Pradesh	16 years (1946-62)	2.86	To multiply the improved strains of castor (H.S. 6) and distribute it amongst the cultivators	—	Scheme taken over from I.C.A.R. in 1948
Establishment of regional arboretum of oil-bearing trees	Andhra Pradesh	5 years (1955-60)	0.44	To establish arboretum of oil-bearing plants with a view to studying their phases of development and commercial utilisation	—	
Research on *Brassica*	Assam	7 years (1951-58)	0.92	To undertake cultural, manurial and rotational experiments in order to evolve improved strains of *Brassica*	—	
Multiplication and distribution of improved strains of mustards	Assam	5 years (1953-58)	0.32	To multiply and distribute the improved strains of oilseeds evolved in the State	—	
Evolution of high-yielding varieties of oilseeds	Bihar	10 years (1951-61)	1.87	To evolve improved strains of linseed and mustard as the main crops, and castor and sesamum as subsidiary crops	—	
Research on groundnut	Bombay	10 years (1951-61)	1.23	To evolve races with high yield, high oil content, high shelling out-turn, low free fatty acid content, shorter duration and resistance to drought and pests and diseases	—	
Improvement of castor crop	Bombay	5 years	0.74	To obtain high yielding strains with high oil content	—	
Improvement of sesamum crop	Bombay	5 years	0.54	To obtain high yielding strains with high oil content of sesamum	—	
Establishment of Oilseed Substation, Parbhani	Bombay	6 years (1951-57)	0.67	To evolve best yielding varieties of castor suitable for cultivation in these areas	—	
Research on groundnut and sesamum	Bombay	5 years	0.47	To carry out botanical improvements on groundnut and sesamum crop	—	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL OILSEEDS COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Research on oilseeds	Bombay	5 years	0.47	To carry out botanical improvement on rape, mustard and sesamum	—	
Investigating the life history and control measures of sesamum gall fly	Bombay	3 years	0.21	To evolve suitable cultural or insecticidal measures for the control of sesamum gall fly	—	
Investigating into leaf spot disease (*Tikka*) and sclerotium disease of groundnut	Bombay	5 years	0.21	To evolve suitable measures for the control of leaf spot and sclerotium disease of groundnut	—	
Research on the cultivation of the West African Oil Palm	Bombay	3 years (1954-57)	0.09	(*i*) To determine the climatic and soil conditions required for the optimum growth of the palm in India (*ii*) To find suitable strains for Indian conditions, and (*iii*) To determine the water and manurial requirement of the palm in the different climatic areas	Report awaited	
Agronomic investigations on groundnut	Shivaji Education Society, Amravati	3 years (1956-59)	0.27	To conduct agronomic experiments on groundnut with a view to find out the optimum seed rate, optimum spacing, economic doses of fertilizers and suitable combination with organic and inorganic manures	—	
Establishment of arboretum of oil-bearing trees	Kerala	5 years (1955-60)	0.47	To study various phases of development and commercial utilisation of oil-bearing plants	—	
Research on cytology of groundnut	Madras	5 years (1955-60)	0.34	(*i*) Study of chromosome complements of wild species and cultivated varieties of groundnut, (*ii*) hybridisation between species and study of inter species hybrids and their progeny, (*iii*) production of new forms of the plant by induction of polyploidy and mutation	—	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL OILSEEDS COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Research on the physiology of groundnut	Madras	5 years (1955-50)	0.85	Study of nutrition, pre-treatment of seeds, dormancy, duration, drought resistance and trace elements	—	
Intensive breeding of groundnut	Madras	5 years (1955-60)	0.31	To evolve improved strains of groundnut	—	
Improvement of 'Pollachi Red' bunch variety of groundnut	Madras	5 years (1956-61)	0.46	To evolve groundnut strains with high yield, high oil content and dormant nature of seed suited to the Pollachi tract	—	
Devising improved machinery driven by bullock and power	Madras Kerala	5 years (1953-58)	1.36 0.93	To devise a suitable machinery driven both by the bullock and tractor for cultivating and harvesting of groundnut	—	
Zonal nucleus seed farms of improved strains of groundnut and castor	Madras	9½ years (1951-61)	2.68	To multiply the selected strains of groundnut and castor in zonal nucleus seed farms	—	
Crop competition on groundnut	Madras	6 years (1956-62)	0.06	To develop cultivation of groundnut through scientific methods and adoption of improved strains and cultural practices	—	
Physiological research on linseed	Madhya Pradesh	5 years (1956-61)	0.94	To determine the mineral requirements of the crop, the effect of trace elements on its growth under field and plot conditions and the effect of spacing and intercropping with wheat on its growth and yield	—	
Testing disease resistance in linseed varieties	Madhya Pradesh	5 years (1953-58)	0.27	To test the varieties of linseed evolved in Uttar Pradesh and Madhya Pradesh for disease resistance	—	
Research on rape and mustard	Madhya Pradesh	3 years	0.09	To evolve improved varieties of rape and mustard with high yield and oil content	—	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL OILSEEDS COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Multiplication and distribution of improved groundnut	Madhya Pradesh, Bombay	3 years (1955-58)	0.29	To produce pure seed of AK-12-24 variety and distribute it to cultivators	—	
Establishment of regional arboretum of oil-bearing trees	Mysore	5 years (1955-60)	0.47	To establish arboretum of oil-plants in different parts of Dharwar for studying the various phases of development and commercial utilisation	—	
Multiplication and distribution of improved groundnut seeds	Mysore	5 years (1955-60)	0.56	To multiply and distribute the improved strains of H.G.8, H.G. 7 and H.G. 10	—	
Research on oilseed crops	Orissa	5 years	0.31	To breed improved strains of sesamum and niger	—	
Improvement of linseed and sesamum crops	Punjab	13 years (1948-61)	1.00	To evolve improved strains of linseed, sesamum and castor	—	
Improvement of groundnut crop	Punjab	10 years (1949-59)	1.30	To breed improved strains of groundnut and conduct agronomic experiments	—	
Improvement of *Brassica* crops	Punjab	6 years (1952-58)	0.81	To evolve improved strains of brown *sarson* and *toria*, and conduct agronomic experiments	—	
Improvement of oilseed crops	Punjab	8 years (1950-58)	1.21	To evolve types with high yields and oil content and resistant to frost, cold and aphids	—	
Research on diseases of groundnut crop	Punjab	5 years	0.37	To investigate diseases of groundnut together with their control measures	—	
Seed multiplication of K-2 improved variety of linseed		5 years (1954-59)	0.60	To multiply K-2 variety and to distribute it among cultivators in Kangra District	—	
Research on genetics and breeding of mustard	Banaras University	5 years (1953-58)	0.65	Isolation of lines of self fertility and self sterility use of male sterile plants for raising hybrid seed, utilisation of hybrid generation for breeding of superior strains, etc.	—	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL OILSEEDS COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Research on oilseed crops	Uttar Pradesh	10 years (1951-61)	2.15	To evolve improved varieties of linseed, mustard, groundnut, sesamum and castor	—	
Anatomical and morphological studies of fruits and seeds of some crucifers with particular reference to oil-yielding plants	Uttar Pradesh	5 years	0.29	To study the structure and development of fruits and seeds of the common oil-yielding species of *Brassica*	—	
Inducing mutants with desirable economic characters in *til*, and rape and mustard by X-rays	Bose Institute, Calcutta	8 years (1950-58)	2.07	To evolve economic mutant in the oilseed crops and to obtain data regarding mutability, cytology, origin and inter-relation-ships	—	
Installing a "20 Curie Cobalt 60 field source" for gamma irradiation in oilseeds	I.C.J.C	—	0.15	To investigate the effects of beta rays from P.32 and 8.35 and of gamma rays from Cobalt 60	—	
Research on oilseed crops	W. Bengal	8 years (1950-58)	1.74	To breed suitable types of oilseeds by a systematic study of available type in West Bengal and outside	—	
Research on pests of oilseed crops	W. Bengal	3 years	0.22	To study the life history, seasonal incidence, host plants and insecticidal control of mustard aphis, and to survey the important pests affecting oilseeds grown in West Bengal	—	
Multiplication of improved strains of mustard	W. Bengal	5 years (1953-58)	0.28	To multiply and distribute the improved strains of *Toria* 7 and *Rai* 5	—	
Multiplication of improved types of linseed and extraction of its fibre	W. Bengal	5 years (1954-59)	0.47	To multiply and improve dual purpose variety of linseed so as to cover an area of 42.000 acres. Also to undertake investigations on the methods of extraction of linseed fibre	—	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL OILSEEDS COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Multiplication and distribution of improved groundnut seed	W. Bengal	3 years (1956-59)	0.99	To multiply and distribute the seeds of high yielding A.H. 45 type	—	
Cytological studies on some oilseed crops	I.A.R.I.	10 years (1951-61)	1.16	Evolving a technique of induced autopolyploidy and amphidiploidy in linseed, sesamum and mustard, and study of mutagens and X-rays	—	
Physiological investigations on autotetraploids of some oilseed crops	I. A.R.I.	5 years (1954-59)	0.38	(i) Growth analysis of diploids and tetraploids of Brassica, sesamum and linseed	—	
				(ii) Investigation of causes of low germination of tetraploid seeds and of factors concerned with oil production by diploids and tetraploids		
Linseed rust	I.A.R.I.	3 years (1956-59)	0.68	Studies on rust of linseed and analysis of rust collection from different parts of the country	—	
Research on virus diseases of oilseed crop	I.A.R.I.	6 years (1952-58)	0.34	To carry out fundamental research on phyllody disease of sesamum and other virus diseases of oilseeds crops	—	
Agronomical studies on oilseeds	I.A.R.I.	5 years (1952-57)	0.24	To conduct experiments on (i) Mixed cropping (ii) Standardisation of manurial and cultural schedules	—	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL OILSEEDS COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Pilot plant studies on cotton seed crushing	Andhra Pradesh	3 years (1954-57)	0.48	To work out the economics of cotton seed crushing in India	Report awaited	
Utilisation of linseed straw as linseed fibre	Bihar	2 years (1955-57)	0.25	To collect linseed straw to process it into fibre and to study the utility of the fibre	do.	
Increasing the production of oilseeds	Uttar Pradesh	2 years (1955-57)	0.38	To increase the production of groundnut, sesamum and caster	do.	
Study of the effect of different conditions of storage of oilseeds and oils	Uttar Pradesh	2 years (1956-58)	0.12	To find out optimum conditions for the storage of mustard and linseed and their oils	—	
Experiments on exploitation of *sal* seed	Uttar Pradesh	1 year (1957-58)	0.16	To explore the possibility of economic extraction of oil from *sal* seed and its utilisation in industry	—	
Study of conditions of storage of oilseeds with regard to their safety from pest attacks, etc.	Uttar Pradesh	2 years (1957-59)	0.08	To study the conditions of storage of oilseeds with regard to their safety from pests and the keeping quality of their oil content	—	
Purifying and refining of *neem* oil	N.C.L. Poona	3 years (1954-57)	0.38	To carry out investigations on pilot plant scale for refining, deodorisation and hydrogenation of *neem* oil	Report awaited	
Utilisation of non-edible vegetable oils as lubricants	N.C.L. Poona	2 years (1956-58)	0.32	To find out the possibility of using cheap non-edible oils like *neem*, *karanja*, *punnal*, *mahua*, etc. for the manufacture of lubricants for use in I.C. Engines	do.	
Effects of different methods of storage of cotton seed and its oil	Regional Research Laboratory, Hyderabad-Dn	3 years (1954-57)	0.15	To carry out investigations on storage of cotton seed and its oil	do.	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL OILSEEDS COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Nutritional studies on groundnut and *til* oils	Indian Institute of Science, Bangalore	3 years (1956-59)	0.20	To carry out nutritional studies on groundnut and *til* oils as obtained by *ghani*, expeller and solvent extraction processes	—	
Study of the preparation and properties of surface active agents from castor oil	Bombay University	1 year (1956-57)	0.04	To explore the possibility of increasing the degree of sulphation of castor oil	Report awaited	
Utilisation of inedible oils as wetting agents in textile industry	Calcutta University	2 years (1955-57)	0.07	To devise methods for sulphonating the inedible oils like *polang*, *karanja*, *pakra*, etc. and their fatty acids in order to produce wetting agents for textile industry	do.	
Study of new antioxidants related to plant pigments	Delhi University	2½ years (1955-57)	0.18	To carry out investigations on the possibility of use in edible oils of anti-oxidant materials present in barks and seeds of some plants	do.	
Grant of interest-free loans to Market Committees for the construction of godowns	Andhra Pradesh	—	0.96	To assist the Market Committees to construct godowns for the storage of agricultural produce to avoid distress sales of oilseed crops	—	
Grant of interest-free loans to Market Committees for the construction of godowns	Bombay	—	1.00	To assist the Market Committees to construct godowns for the storage of agricultural produce to avoid distress sales of oilseed crops	—	
Survey of minor oilseeds	W. Bengal	1 year (1956-57)	0.04	To conduct an economic survey (botanical and chemical) of all oil-bearing plants and seeds in India	—	
Survey of minor oilseeds	Bombay (Saurashtra)	1 year (1956-57)	0.05	To conduct an economic survey (botanical and chemical) of all oil-bearing plants and seeds in India		

INDIAN CENTRAL TOBACCO COMMITTEE

Headquarters—Madras (Madras State)

INDIA is one of the most important and largest tobacco producing and consuming countries in the world. Nearly 8 to 9 lakhs of acres of tobacco are grown annually in the country. Of the total acreage, nearly 25 per cent is under *Nicotiana rustica*, the rest under *Nicotiana tabacum*. *Rustica* tobacco is mostly confined to north and north-eastern regions of the country, while *tabacum* is grown throughout the country. In each of the species there are distinct varieties which have developed through centuries for specific uses. According to their uses, the regions for various important tobaccos in the country are indicated below:

A. *Nicotiana rustica* (hookah, chewing and snuff)

(1) Motihari	North-west Bengal
(2) Vilayati	North-Bihar
(3) Kalkatia	Uttar Pradesh and the Punjab

B. *Nicotiana tabacum* (bidi, cigar, cigarettes, chewing and snuff)

(1) Jati	North-west Bengal
(2) Bidi	North Gujarat—Bombay
(3) Bidi	Nipani area (northern Mysore)
(4) Virginia	Guntur and Kovur zones—Andhra
(5) Natu	Guntur zone—Andhra
(6) Lanka	Various islands of Godavari and Krishna—Andhra
(7) Cheroot and chewing	Tiruchirapalli, Dindigul, Coimbatore—southern Madras

It will be seen that tobacco is a very important commercial crop in various regions of the country, especially in States like Andhra Pradesh, and reorganised Bombay and Mysore. It employs thousands of workers not only in agriculture but in the industrial field also. For the farmers, tobacco brings an annual return of nearly 33 crores of rupees and a similar amount to the National Exchequer in the form of excise duty. Besides, tobacco earns foreign exchange to the extent of about Rs. 13 crores annually.

Realising the importance of tobacco in the nation's economy, the then Government of India imposed in April 1943 an excise duty on various types of tobaccos at varying rates, and from the proceeds set apart annually a sum of Rs. 10,00,000 for the improvement of tobacco in the country. The then Imperial Council of Agricultural Research administered the grant till a Central Tobacco Committee was constituted in 1945 and took over various schemes being administered by the I.C.A.R.

ORGANISATION

In order to make the Committee representative of all tobacco concerns, persons with various tobacco interests are nominated to be representatives on the Committee. Until recently, the Vice-President of the Indian Council of Agricultural Research was the ex-officio President of the Committee.

The present modified constitution of the Committee, indicating the frequency and the type of representation of various bodies and States, is as follows:

1. Agricultural Commissioner with the Government of India (ex-officio President)
2. Additional Agricultural Commissioner with the Government of India
3. Agricultural Marketing Adviser to the Government of India
4. A representative of the Ministry of Commerce and Consumer Industries, to be nominated by the Central Government

5-6. Two representatives of the Ministry of Finance (one from the Central Board of Revenue and the other from Expenditure General side), to be nominated by the Central Government

7-9. Three persons to represent consumers, namely, one member of the Rajya Sabha and two members of the Lok Sabha, to be elected, respectively, from among themselves.

10-18. Nine representatives of the Departments of Agriculture to be nominated by the Governments of Andhra Pradesh, Assam, Bihar, Bombay, Madras, Mysore, Orissa, Uttar Pradesh and West Bengal

19-35. Seventeen representatives of the growers, to be nominated by the Central Government in consultation with the State Governments—five from Andhra Pradesh, three from Bombay, two from Mysore, one each from Assam, Bihar, Madras, Orissa, Uttar Pradesh and West Bengal and one from Madhya Pradesh, Punjab and Rajasthan by rotation

36-37. Two representatives of the co-operative movement, one each from North and South India, to be nominated by the Central Government

38-43. Six trade representatives, to be nominated by the Central Government after consulting appropriate trade organisations for the following types of tobacco: two for bidi and one each for cheroot, cigar, hookah and chewing

44-46. Three trade representatives for cigarette tobacco (including one representative of small manufacturers), to be nominated by the Central Government after consulting appropriate trade organisations

47. One representative of the Federation of Indian Chambers of Commerce and Industry

48. One representative of the Associated Chambers of Commerce

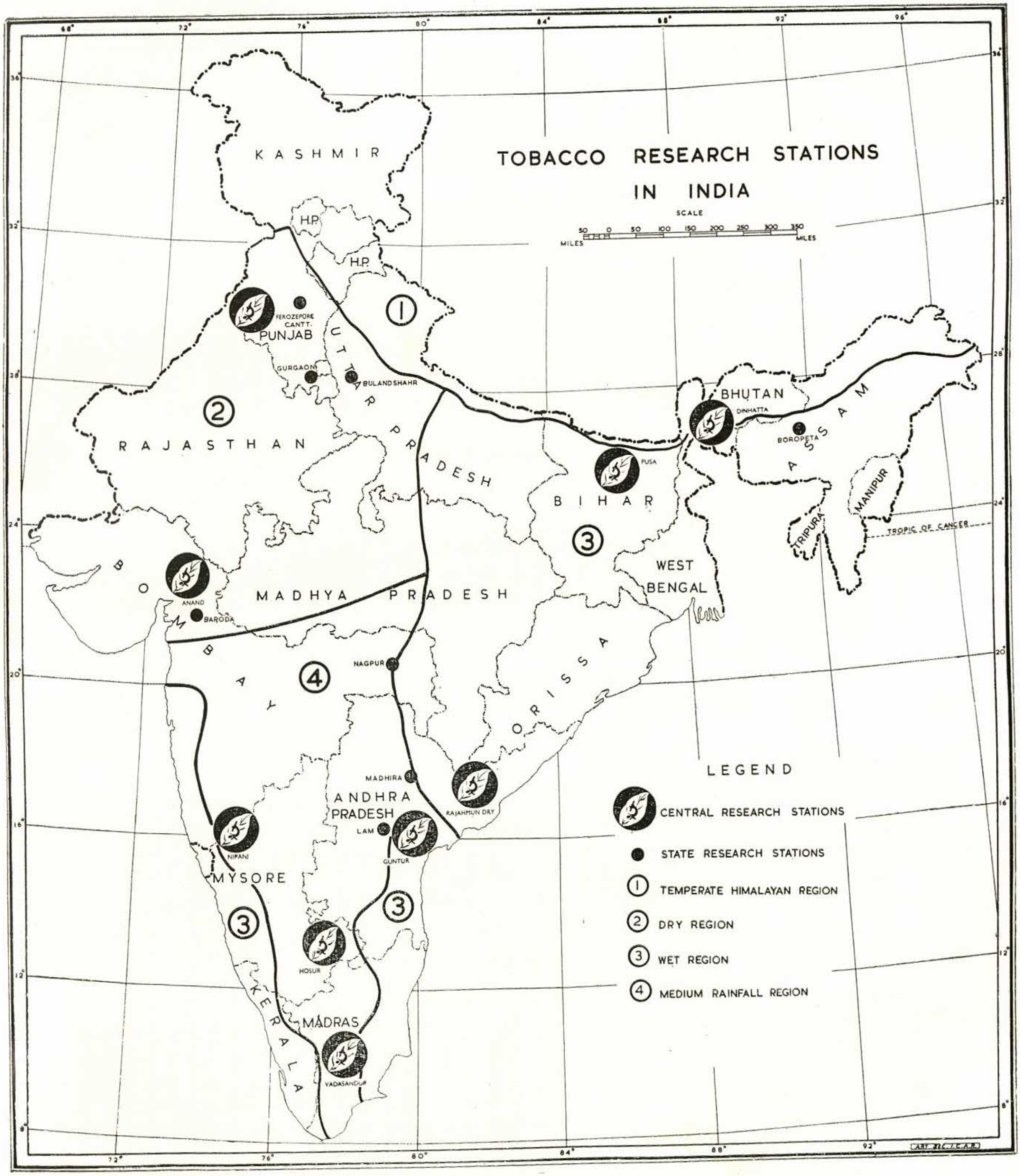
49-53. Five members to be nominated by the Central Government

SOURCE OF REVENUE

The Committee receives from the Central Government annually a non-lapsable grant of Rs. 12 lakhs for administration and for financing schemes of research, marketing and other developments. The Committee is also provided a special grant for financing schemes in the Second Five-Year Plan. Other sources of income are mainly from the sale of farm produce of research stations under the control of the Committee. Thus the annual income of the Committee is round about Rs. 15-16 lakhs.

FUNCTIONS

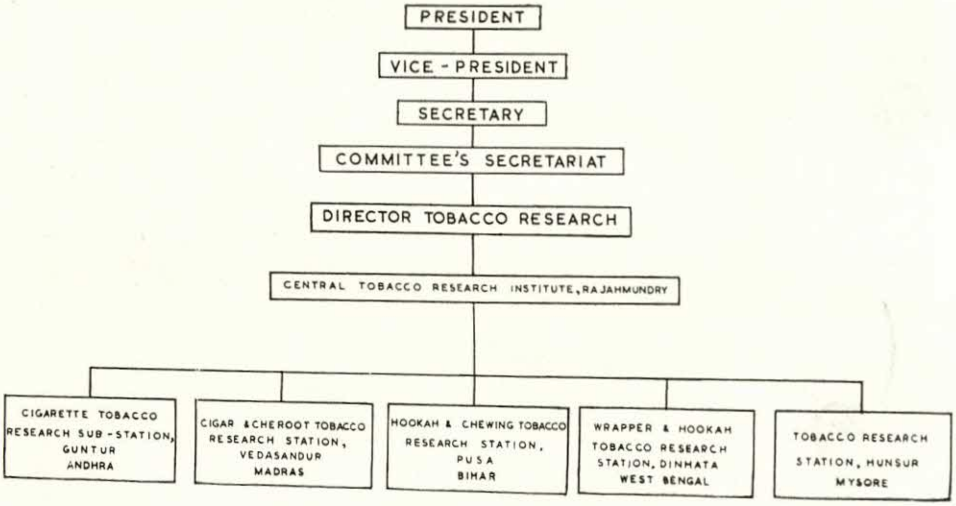
The functions of the Indian Central Tobacco Committee are to assist in various ways possible the improvement and development of production and marketing of different kinds of tobaccos and their products in the country. This requires the Committee to undertake, assist and encourage agricultural, industrial, technological and economical research. In order to do so effectivly, the Committee maintains its own research stations and finances various schemes by inviting applications for financial assistance from the State Governments, Universities, and even private individuals for such schemes as fall within the purview of its functions.


TOBACCO RESEARCH STATIONS IN INDIA
SCALE
50 0 50 100 150 200 250 300 350
MILES
MILES
KASHMIR
H.P.
H.P.
PUNJAB
FEROZEPORE CANTT.
GURGAON
BULANDSHAHR
UTTAR PRADESH
RAJASTHAN
BHUTAN
DINHATTA
BOROPETA
ASSAM
PUSA
BIHAR
WEST BENGAL
MANIPUR
TRIPURA
TROPIC OF CANCER
BOMBAY
ANAND
BARODA
MADHYA PRADESH
NAGPUR
ORISSA
MADHIRA
ANDHRA PRADESH
LAM
GUNTUR
RAJAHMUN DRY
NIPANI
MYSORE
HOSUR
KERALA
MADRAS
VADASANDUR
①
②
③
④
LEGEND
CENTRAL RESEARCH STATIONS
STATE RESEARCH STATIONS
① TEMPERATE HIMALAYAN REGION
② DRY REGION
③ WET REGION
④ MEDIUM RAINFALL REGION
68° 72° 76° 80° 84° 88° 92° 96°
36° 32° 28° 24° 20° 16° 12° 8°
ART. SEC. I.C.A.R.

INDIAN CENTRAL TOBACCO COMMITTEE

Headquarters—Madras (Madras State)

Organisation Chart


PRESIDENT
VICE - PRESIDENT
SECRETARY
COMMITTEE'S SECRETARIAT
DIRECTOR TOBACCO RESEARCH
CENTRAL TOBACCO RESEARCH INSTITUTE, RAJAHMUNDRY
CIGARETTE TOBACCO RESEARCH SUB-STATION, GUNTUR ANDHRA
CIGAR & CHEROOT TOBACCO RESEARCH STATION, VEDASANDUR MADRAS
HOOKAH & CHEWING TOBACCO RESEARCH STATION, PUSA BIHAR
WRAPPER & HOOKAH TOBACCO RESEARCH STATION, DINHATA WEST BENGAL
TOBACCO RESEARCH STATION, HUNSUR MYSORE

The Committee's aid is ordinarily limited to a period of not more than 10 years for agricultural research schemes, five years for developmental, marketing and seed multiplication schemes and only three years for schemes of technological nature. The schemes are subject to review at the end of the third, fifth and eighth years.

In the case of agricultural research schemes the Committee's help is ordinarily confined to the recurring expenditure for staff and contingencies and non-recurring expenditure on special scientific equipment required. The responsibility for capital expenditure, such as land, buildings, offices, office equipment, etc. is of those sponsoring the scheme.

For developmental and marketing schemes, the Committee's subvention is limited to full recurring expenditure, while seed multiplication and distribution schemes are ordinarily run on a self-supporting basis. In cases where the schemes are run on a subsidised basis, the Committee's share of expenditure is limited to either cost of the staff or to incidental charges for distribution.

Seed schemes are extended to a further period of five years provided that the Committee's share of expenditure does not exceed 75 per cent of either the pay of staff or the incidental expenditure, and the party sponsoring the scheme contributes not less than the sum spent during the original period of scheme. It is not necessary, however, that the grant for the renewal period should be less than that for the first sanctioned period provided the Committee's contribution does not exceed 75 per cent. Receipts, if any, from the scheme are deducted from the cost of the scheme and the balance only shared on the basis stated above.

After the seed scheme has run for a period of 10 years, the Committee's contribution during the next five years is limited to 33 per cent of the cost of the staff or incidental expenses subject to a maximum of 15 per cent of the total cost of the scheme during the extension period.

In the case of the schemes for technological research, only the net recurring expenditure is financed in full by the Committee for a period of three years. To justify further financial help from the Committee after this period, special technical or scientific reasons are necessary, particularly, if the Committee's share of expenditure is to exceed the limited 50 per cent of the net recurring expenditure.

The Committee conducts its business through the following four main sectional Sub-Committees and holds general meetings twice a year to review the progress of work and to accord budgetary sanctions for various schemes:

1. Policy and Finance Sub-Committee
2. Agricultural Research Sub-Committee
3. Statistical, Marketing, Technological Sub-Committee
4. Scientific Appointments Sub-Committee

ACHIEVEMENTS

The Central Tobacco Committee has established its own Central Tobacco Research Institute at Rajahmundry, Andhra Pradesh. The Institute is mainly devoted to fundamental investigations in agronomy, chemistry, cytology, genetics, physiology and diseases and pests of tobacco. The Institute has also devoted considerable attention to practical problems concerning production and quality of flue-cured tobacco.

Since its establishment in 1947, it has made some important contributions to the tobacco industry which are briefly enumerated below:

1. A new flue-cured variety Chatham has been evolved by the Institute which is superior in leaf characters and yield to the prevailing variety Harrison Special. Chatham gives larger amounts of bright grades and responds better to topping than the older variety. The Institute has also made considerable headway in developing new synthetic strains of cigarette tobacco and some of these are far superior to Chatham and Harrison Special. These are in the final stages of testing at the Institute.

An improved strain of Lanka tobacco No. 27 has been found to be superior to the local variety. Another strain which is even better than Lanka-27 has been found recently.

Application of farmyard manure as one inch thick top layer has been found to give larger number of transplantable seedlings. Similar results were obtained when groundnut cake was used at the rate of 80 lb.N per acre. This method can relieve the farmer from depending on commercial nurserymen and he can have successful nurseries on his own farm.

It has been found that flue-cured tobacco responds better to nitrogenous manuring at the rate of 20 lb. of nitrogen per acre. Nitrogen has shown a residual response for as long as four years.

It has been found that judicious topping of flue-cured variety and light irrigation increase yields considerably without affecting quality.

The development of suckers after topping is effectively suppressed by application of drops of coconut oil to leaf axils.

The Institute has developed a modified method of curing which results in better grades of tobacco and at the same time saves fuel.

The incidence of "Damping off", which is a very serious disease of tobacco seedlings can be effectively controlled by spraying every three days with Perenox at the rate of 2½-5 gallons of 2 oz. per 10 gallon spray.

The incidence of powdery mildew has been effectively controlled by application of sulphur dust at the rate of 20 lb. per acre between rows of tobacco.

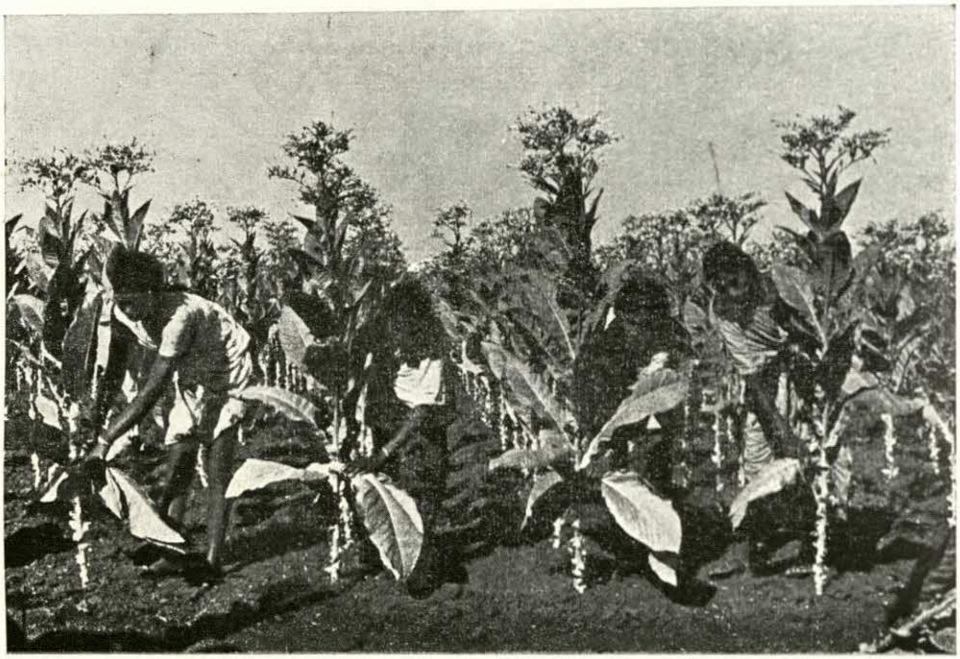
Experiments conducted by the Institute have clearly shown that the phanerogame parasite Orobanche can be effectively controlled by merely pulling out the Orobanche plant before it starts flowering. Heavily infested fields can be completely freed from the parasite within three years. Experiments have also indicated that seeds of Orobanche are not widely disseminated by air currents as was generally believed.

The Institute has developed an efficient seed production and supply system which is proving a good model for others to follow.

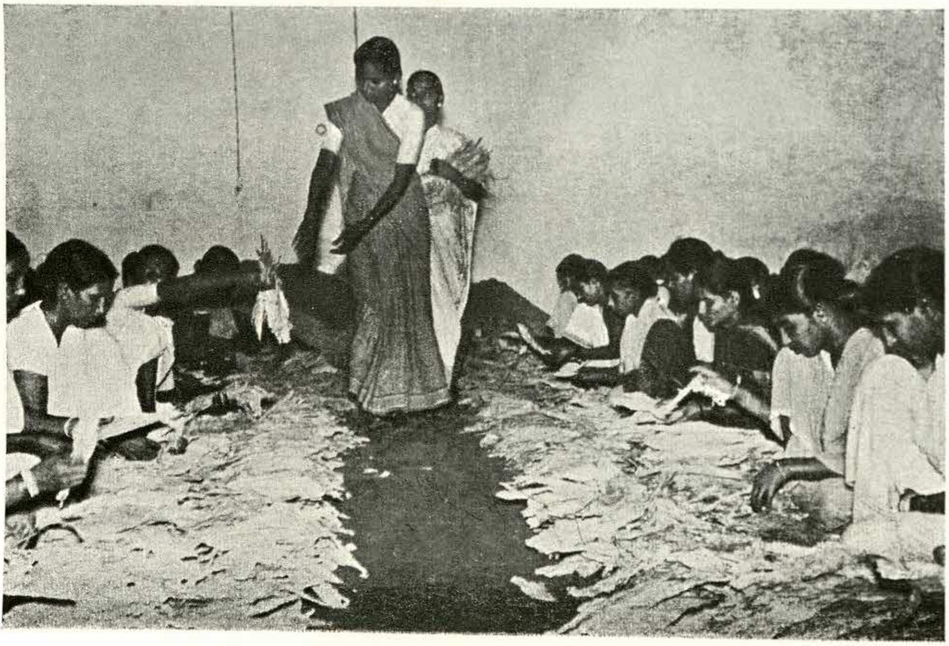
Besides the Institute, the Committee has established a number of experiment stations in various parts of the country for improvement of the more important tobaccos. These stations are in various stages of development. The more important results achieved at each of these stations are summarised in the following.

Central Tobacco Research Institute, Rajahmundry (laboratories under construction)

Stringing the harvested leaves of Lanka tobacco



Harvesting mature leaves of Virginia tobacco, Andhra



Grading flue-cured tobacco

Cigarette Tobacco Research Substation, Guntur, (Andhra Pradesh)

The Station is mainly devoted to better methods of cultivation of cigarette tobacco. It is also dealing with Natu tobacco, an important local tobacco used in hand-rolled cigarettes and low priced cigarettes.

The Station has found over a period of five years that the farm method of curing cigarette tobacco, as demonstrated on farmers' fields with their own material, was far superior to the local method of curing. On an average of five years, the farm method fetched Rs. 63 more per candy of 500 lb. than the farmers' method. On an average, the farm method requires 350 lb. of less coal and 9 hours of less time per cure than the farmers' method.

The Station has found that topping Natu tobacco by removal of the terminal inflorescence gives higher yield without loss of quality, instead of leaving certain number of leaves as is the general practice.

Cigar and Cheroot Tobacco Research Station, Vedasandur (Madras State)

The Station deals with various agronomical, chemical and breeding of strains of cigar and chewing tobaccos of the southern region in the Madras State. The most important findings of the Station are briefly stated below:

Manuring of cigar and cheroot tobaccos with 20 cartloads of F.Y.M. and 500 lb. of sulphate of ammonia with topping at 14 leaves and spacing at 30 in. × 20 in. has given on an average 400 lb. more of good grade leaf per acre than the farmer's practice of applying 40 cartloads alone per acre and topping plants at 12 leaves with spacing at 30 in. × 24 in.

If an assured water supply is available, earlier plantings in October give larger yield than later ones.

Hookah and Chewing Tobacco Research Station, Pusa, (Bihar)

This Station is mainly devoted to agronomic work on hooka tobacco belonging to both the species, *rustica* and *tabacum.*

Two bulk collections of *tabacum* "Bori" and "Dhamakul" have proved superior over a period of five years with 9 per cent increase in total yield and 15 per cent in first grade leaf over the standard strain N.P. 70.

Among the *rustica*, N.P. 216 has proved highest yielding.

The economical dose of N. is 50 lb. per acre. It not only increases the total yield but the first grades are increased by as much as 35 per cent.

Application of coconut oil to axils of leaves in topped tobacco suppressed suckers and increased first-grade leaf by 25 per cent, although there was no increase in total yield.

Wrapper and Hookah Tobacco Research Station, Dinhata (West Bengal)

The Station is established mainly for the development of wrapper tobacco studies, as in this area both climate and soil conditions are most suitable for production of fine quality of wrapper tobacco, The Station also concerns itself with the general improvement of the two most predominant tobaccos, Jati (*tabacum*) and Motihari (*rustica*).

The Station is experimenting with growing of wrapper tobacco under shade to see if very high quality wrapper can be grown.

It has developed 3 to 4 higher yielding strains in both Motihari and Jati varieties of tobacco.

Bidi Tobacco Research Scheme, Anand (Bombay State)

The Committee had its own research station at Anand for some time. Later the station was abolished and the work transferred as a scheme to the Agricultural Research Institute, Anand.

The following are the important findings concerning bidi tobacco in Gujarat:

Manuring seed-beds with 80 lb. nitrogen as castor cake before sowing and top-dressing with 80 lb. nitrogen as ammonium sulphate subsequently, gave more and sturdy seedlings than farmyard manure alone. Four and quarter pound seeds per acre of nursery have been found to be the optimum.

Optimum range of fertilisation was found to be between 80 and 160 lb. nitrogen per acre in the form of oilcakes, depending on soil conditions. Manuring within this range together with planting at 3 ft. × 3 ft. spacing and topping at 11 leaves was found to give better quality crop with higher economic returns than the farmers' method of manuring with five tons of farmyard manure with 40 lb. nitrogen as oilcake, 2½ ft. × 2½ ft. spacing and topping at 14-15 leaves.

A new selection K-20 has been evolved which is higher yielding than the current strain of Keliu variety, K-49.

Bidi Tobacco Research Substation, Nipani (Mysore State)

The Station is mainly meant for improvement of bidi tobacco in the Nipani zone. It is also experimenting with cigarette tobacco.

The Station has evolved a high-yielding strain, S-20 of bidi tobacco.

Hooka Tabacco Research Substation, Ferozepur (Punjab)

Work on hookah tobacco belonging to both the species, *tabacum* and *rustica*, is going on at Ferozepur. Important findings of the Station are summarised below:

High-yielding strains Nos. 218 and 238 among the *rustica* have been found.

The best period for transplanting has been found to be mid-February. Later plantings as practised by the farmers give reduced yield.

For both *rustica* and *tabacum*, 100 lb. nitrogen, half in the form of sulphate of ammonia, half in the form of groundnut cake when applied in two doses, once at planting and the rest at the time of flowering, has given economically high yield.

Growing of tobacco continuously without rotation has been found to give better yield and quality than when tobacco is rotated with maize, potato or *chari*.

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL TOBACCO COMMITTEE

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
			CURRENT SCHEMES			
Cultivation of Jaffna tobacco	Kerala	3 years (1955-58)	0.08	To explore the possibility of cultivation of Jaffna tobacco.	—	
Production of cigarette tobacco	Institute of Agriculture, Anand	To continue indefinitely	7.23 (upto 1957)	To effect improvement and development of all aspects of bidi tobacco	Manuring the nursery beds with 80 lb. of N as oilcake. top dressing at 80 lb. N. and the seed rate of 4½ lb. per acre could be recommended as optimum. A high yielding strain K. 20 evolved.	
Bidi tobacco seed multiplication	Institute of Agriculture, Anand	13 years (1951-64)	2.74	To produce and supply good seeds to cultivators	The seed and seedlings produced and distributed created considerable confidence in the public and are in heavy demand	
Study of physical and chemical characters of bidi tobacco	Institute of Agriculture, Anand	6 years (1954-60)	0.29	To standardise the grades and work out grade index, if possible	—	
Hookah tobacco research	Punjab	11 years (1948-59)	1.94	To conduct agricultural research on different aspects of hookah tobacco	Continuous cultivation of tobacco without rotation gives better yield and quality than when grown in rotation with maize, potato and *chari*. The optimum dose of N for hookah tobacco was found to be 100 lb. per acre, half as sulphate of ammonia and half as groundnut cake to be applied in two split doses—one at planting and the other at flowering. The optimum period of transplanting was found to be middle of February. High-yielding strains, *viz*. No. 218 and 238 evolved	
Bidi tobacco research	Mysore	9 years (1949-58)	1.24	To explore the possibility of growing, improving and flue-curing cigarette tobacco and improvement of bidi tobacco for yield and quality	An early maturing strain S-20 released for general cultivation	
Improvement of indigenous tobacco	Uttar Pradesh	3 years (1955-58)	0.31	To improve the quality and yield per acre	—	
Research on cigarette tobacco	Uttar Pradesh	5 years (1954-59)	0.16	To explore the possibility of economically cultivating virginia tobacco of good variety and high yield	—	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL TOBACCO COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Research on cigarette tobacco	West Bengal (Mohitnagar)	3 year (1956-59)	0.07	To grow, cure and produce high grade cigarette tobacco	—	
Research on cigarette tobacco	West Bengal (Dinhata)	1 years	0.08	-do-	—	
Control of leaf burn of tobacco	Bombay	3 year		To evolve measures to eradicate a new disease, which should be appropriately called 'leaf-burn' infecting the bidi tobacco crops	—	
Investigation and control of cigarette tobacco beetles in tobacco storage	I.C.T.C.	3 years (1955-58)	0.19	To find out ways and means to control tobacco pests in storage	—	
Classification of V.F.C. lands into saline and non-saline areas	I.C.T.C.	2 years (1956-58)	0.23	For classifying saline land	—	
Cytological studies in *N. tabacum* and *N. rustica*	I.C.T.C.	3 years (1957-60)	0.19	For undertaking cytological studies in Indian types of *N. tabacum* and *N. rustica*	—	
Wrapper tobacco trials at high altitudes	Madras	1 year (1957-58)	0.06	For finding out the possibility of growing good quality wrapper tobacco in high altitudes	Encouraging results obtained	
Comparative trials of farm vs. farmers' methods of cultivation in tobacco growers' fields	Bihar	3 years (1955-58)	0.09	To compare yields obtained from the two methods	Farm methods applied in cultivators' fields gave average increase of 45 per cent in total yield	
Laboratory and library equipment for the Central Tobacco Research Institute, Rajahmundry	I.C.T.C.	5 years (1956-61)	2.30	To equip the Institute with up-to-date equipment and books and journals in the interest of research	—	
Expansion of the Central Tobacco Research Institute, Rajahmundry	I.C.T.C.	5 years (1956-61)	5.40	To equip the Institute with additional land, and ancillary structures such as green and glass houses and insectary and to add an appraising section for revaluation of the leaf produced on the farm	—	
Hookah and chewing Tobacco Research Station, Pusa, construction of residential quarters	I.C.T.C.	3 years (1956-59)	2.00	To construct residential quarters for the staff working at the Research Station	—	
Bidi Tobacco Research Scheme, Anand Extension	I.C.T.C.	5 years (1956-61)	2.22	To construct laboratory, glass house, insectary, etc. and purchase equipments for the Station	—	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL TOBACCO COMMITTEE—(*Cotnd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Strengthening Wrapper and Hookah Tobacco Research Station, Dinhata	I.C.T.C.	3 years (1956-59)	1.00	To construct residential quarters for the Research Staff, to improve the farm land by bunding and levelling and to equip it by providing suitable implements, buildings, bullocks, etc.		
Establishment of Tobacco Research Station at Hunsur, (Mysore)	Mysore	5 years (1956-61)	3.12	To effect improvement in both the quality and yield per acre of tobacco produced in Mysore State		
Training in improved methods of tobacco cultivation, handling, curing, etc.	Andhra Pradesh Bombay and Mysore	5 years (1956-61)	2.95	To impart training in improved techniques of production, curing and handling of Virginia and bidi tobacco to growers and Excise and Agricultural Departments, officials and personnel of Community Projects areas who desire to have training in those aspects		
Production and distribution of pure seeds and seedlings	Andhra Pradesh Madras, Bihar, West Bengal, Bombay, Punjab and Mysore	5 years (1956-61)	2.95	To produce and distribute pure seeds and seedlings so that tobacco of uniform improved quality may be produced by the cultivators		
Establishment of exploratory station for G.W.A. tobacco at Kazipet	Andhra Pradesh	5 years (1956-61)	0.41	To raise nurseries on scientific basis and distribute improved seeds and seedlings and to determine adequate doses of different manures and plant protection measures		
Establishment of exploratory station for Virginia Tobacco at Borgampahad	Andhra Pradesh	5 years (1956-61)	0.62	To raise nurseries of Virginia tobacco on scientific basis and distribute the seeds and seedlings and to determine adequate doses of different manures and plant protection measures		

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL TOBACCO COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Scheme for establishment of exploratory station for Nipani tobacco at Alampur	Andhra Pradesh	5 years (1956-61)	0.25	To raise nurseries of Nipani tobacco on scientific basis and distribute the same and to determine adequate doses of different manures and plant protection measures		
Improvement of Meenampalayam tobacco	Madras	3 years (1956-59)	0.12	To improve yield by judicious manuring by selecting the optimum time for planting and by irrigation with channel	---	
Trials of bidi and hookah tobacco	Madhya Pradesh	5 years (1956-61)	0.15	To select suitable types of tobacco for the area	---	
Control of Powdery mildew of cigarette tobacco	Mysore	3 years (1956-59)	0.19	To survey the incidence of and devise control measures for ash disease for powdery mildew	—	
			(CLOSED SCHEMES)			
Research on cigarette tobacco	(*i*) East Bengal	2 years (1945-47)	—	To explore the possibility of successfully growing cigarette tobacco in different tracts of India	—	Scheme closed after partition of country in 1947
	(*ii*) N.W.F.P. (2 stations)	2 years (1945-47)	0.04			
	(*iii*) Punjab	2 years (1945-47)	—			
	(*iv*) Sind	2 years (1945-47)	0.01			
	(*v*) Madhya Pradesh	3 years (1945-48)	0.08		Soil found unsuitable for cultivating cigarette tobacco	
	(*vi*) Bihar (3 stations)	3 years (1946-49)	0.02			One station found unsuitable and the other two closed down due to damage caused by heavy rains
	(*vii*) Orissa (2 stations)	3 years (1946-49)	0.20		Virginia cigarette tobacco could be successfully grown in this area	

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL TOBACCO COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in (lakhs)	Objectives	Achievements	Remarks
	(*viii*) East Punjab (2 stations)	4 years (1945-49)	0.12	To explore the possibility of successfully growing cigarette tobacco in different tracts of India	Possibility of growing cigarette tobacco successfully in Jullundur Station	
	(*ix*) Bombay (3 stations)	4 years (1945-49)	0.21		The tract was found suitable for growing cigarette tobacco successfully	
	(*x*) Madhya Bharat (2 stations)	3 years (1945-48)	0.13		do.	
	(*xi*) Madras (3 stations)	2 years (1948-50)	0.34			Not suitable for cultivation of virginia cigarette tobacco
	(*xii*) Andhra Pradesh (2 stations)	2 years (1948-50)			Cigarette tobacco could be successfully grown in the tract	
Production and multiplication of H.S. 9 tobacco seed	Andhra Pradesh (2 stations)	2 years (1948-50)	0.02	To produce, multiply and distribute seeds of H.S. 9 cigarette tobacco	Objective achieved	
Demonstration of improved methods of cultivation, handling and curing tobacco leaves	Andhra Pradesh (2 stations)	2 years (1950-52)		To bring home to the tobacco grower that his produce would fetch a greater return if it was handled and cured by improved methods	do.	
Investigation into the possibility of growing flue-cured tobacco in paddy lands	Andhra Pradesh	3 years (1954-57)	0.13	To find out the possibility of growing good quality V.F.C. tobacco in paddy lands	—	Good quality V.F.C. tobacco could not be produced in paddy lands
Short training courses in tobacco curing	Andhra Pradesh	8 years (1948-56)		To impart training in improved methods of curing of V.F.C. tobacco	Training imparted	
Growing wrapper tobacco	West Bengal	2 years (1950-52)	0.15	To find out the possibility of successfully growing good wrapper tobacco to demonstrate the correct methods of cultivation, etc.		Station closed down owing to establishment of a Station at Dinhata
Multiplication and distribution of improved strains of bidi tobacco	Bombay	3 years (1951-54)	0.01	To produce, multiply and distribute improved strains of bidi tobacco	—	—

INDIAN LAC CESS COMMITTEE

Headquarters—Ranchi (Bihar)

THE organisation from which later grew the Indian Lac Cess Committee had its origin in the Lindsay-Harlow Report in 1921. The need for this enquiry arose on account of the importance which shellac had assumed during the First World War in the manufacture of gramophone records and electrical goods, as also in many of the requirements of the armed forces. The end of the First World War brought in its wake wide fluctuations in prices which exposed shellac to serious competition from other substitutes.

In 1921, the Government of India deputed Mr. H.A.F. Lindsay, I.C.S. and Mr. C.M. Harlow, I.F.S., to conduct an enquiry into different aspects of lac production. Amongst other recommendations made in their report, it was stressed that scientific research should be conducted on the life histories of the lac insect and its enemies, as well as on the chemistry of lac. In this connection it was suggested that the research should be undertaken by the Lac Association for Research at Calcutta, and expenditure met by the levy of a cess. As a site for the research institute, Jubbulpore was suggested. Further, it was recommended that this Association should publish crop forecasts and undertake propaganda work in foreign countries in course of time.

Lac Association for Research

As a result of the recommendations mentioned above, the Lac Association for Research was organised in 1921, and necessary funds were placed at its disposal by imposing a small cess of 4 annas per maund on all lac other than refuse lac, and of 2 annas per maund on refuse lac. This Association subsequently decided to establish the Indian Lac Research Institute at Namkum (Ranchi) instead of at Jubbulpore.

ORIGIN OF THE COMMITTEE

The Royal Commission on Agriculture in India (1927-28) considered that membership of the Association had been limited to the bigger merchants who could not be expected to take sufficient interest in the improvement of the lot of the village cultivator. The Commission, therefore, suggested that the Government should have its nominees in the Association to watch the interests of the cultivators, and should also have some control over matters of policy.

This recommendation was accepted, and by a statutory enactment the Indian Lac Cess Committee came into being in 1931. Opportunity was also taken to enlarge the functions of the Association to include the investigation of marketing methods and the promotion of sales. At the same time, the cess was raised to 7 annas per maund on all lac other than refuse lac, and to 5 annas per maund on refuse lac.

The Committee was originally a single body, consisting of 17 members. The Vice-Chairman of the Imperial (now Indian) Council of Agricultural Research was its ex-officio President. The other ex-officio members were the Inspector-General of Forests, the Forest Entomologist, the Conservator of Forests, Bihar and Orissa, the Director of Agriculture, Bihar and Orissa, and the Director of the Indian Lac Research Institute. The representatives of the trade included three manufacturers from the manufacturing industry, one representative of the export trade, one representative of the brokers, and five representatives of the cultivators (mostly Government officials).

An amending Act was passed in 1936. It effected a major change in the constitution of the Committee in that the Committee was bifurcated into two bodies, known as the Governing Body and the Advisory Board. In the amending Act, which continues to be in force, the Governing Body consists of 15 members, of which four members represent the shellac manufacturing industry, one each represents the shellac export trade, the lac brokers, and the lac-consuming industries, and six represent cultivators of lac. Besides these, the Chairman and another member are nominated by the Government of India. Members retire after a period of three years though they are eligible for renomination.

The Advisory Board consists of 11 members, which includes the Chairman, two chemists, two entomologists, two forest officers, the Director of Agriculture, Bihar, the Director, Lac Research Institute, and two experts—one representing the lac manufacturing industry, and the other the lac-consuming interests. Most of the members are appointed by designations of posts held by them in other institutions.

During World War II, the financial condition of the Committee deteriorated. Consequently, with effect from April 1, 1948, the cess was raised to 14 annas per maund in respect of exports of seedlac and shellac, and to 10 annas per maund in respect of refuse lac.

The annual income of the Committee is approximately Rs. 7,00,000/- (including income from investments). The bulk of the expenditure falls under the following heads:

	Approximate annual expenditure
(i) Administration of the Committee	Rs. 62,000
(ii) Expenditure on research	Rs. 4,35,000
(iii) Statistics and crop forecasting	Rs. 20,000
(iv) Lac cultivation and extension schemes	Rs. 1,00,000
(v) Grants-in-aid	Rs. 8,000

ACTIVITIES OF THE COMMITTEE

The activities of the Committee may be summarised under the following six heads:

(a) Research in India
(b) Research and sales propaganda abroad
(c) Dissemination of the results of research for the benefit of
  (i) the cultivators of lac
  (ii) the manufacturers and consumers of lac
(d) Crop forecasts and statistics
(e) Measures for the improvement of marketing of lac
(f) Assistance in special enquiries relating to lac

A brief account of the activities of the Committee under the above heads is given below.

Research

The research work has mainly been carried out at the research institute maintained by the Committee, viz. the Indian Lac Research Institute at Namkum. The Institute has two main sections—one dealing with the cultivation and entomology of lac, and the other with the utilisation and chemistry of lac. On the cultivation side, outstanding results have been obtained on forecasting, by a visual method, the emergence of lac larvae, development of better methods of pruning lac hosts, cultivation by the coupé system, preservation of broodlac from the summer crop (a very important and until now a baffling problem), identification and (to some extent) control of the enemies of lac, etc. On the physico-chemical and the industrial side, significant results (in some instances sufficiently important to be of use even outside the field of lac chemistry) have been achieved. Of particular note is the work done on the theory and action of mixed solvents, the dielectric and other physico-chemical properties of lac, isolation of acid constituents of lac, lac-oil varnishes and paints, moulding powders of both the compression and the injection moulding type, various cements and adhesives, the autoclave process of lac melting, bleached lac of improved keeping quality, new (rapid) methods of determining the bleach index and the moisture-content of shellac, improved methods of standardisation and grading, and storage of lac.

Research and sales propaganda abroad

In order to study the needs of the consumers abroad, to maintain liaison with the Indian Lac Research Institute, and to promote sales propaganda for shellac in Europe, the London Shellac Research Bureau was established in 1933, and was staffed with three Indian scientists. A Technical Advisory Committee was set up by the High Commissioner for India in London, which advised him on all matters connected with lac research. The activities of the London Shellac Research Bureau had to be suspended from the 1st April, 1946, on account of the disorganisation caused by World War II as also for lack of funds.

An agreement was entered into with the United States Shellac Importers' Association under which a grant was made to the Association's Research Bureau for promoting the use of lac in American industries. This grant was discontinued in March, 1939. It was then decided that a Special Officer be appointed in New York to maintain closer contact with the principal consumers of lac there.

A Lac Information Officer also functioned in London for conducting sales propaganda abroad. However, in 1948, this post was changed into a combined post of Shellac-*cum*-Tobacco Sales Officer.

Dissemination of results of research

On the cultivation side, the Committee has been running two schemes, viz. the Intensive Demonstration Scheme and the Extension of Lac Cultivation Scheme, for stepping up production.

Intensive Demonstration Scheme. A scheme for the dissemination of the results of entomological research was initiated in 1935. It was modified in 1941 when Provincial Governments were associated with the work and the administrative control was entrusted to them. The function of the Lac Research Institute came to be mainly advisory. Under this scheme the Committee bears 50 per cent of the expenditure, and also supplies broodlac and implements free of cost. The scheme was brought into operation in Bengal in 1943, in Uttar Pradesh in 1944, in Bihar in 1946, and in Bombay in 1952.

Extension of Lac Cultivation Scheme. In 1948, the Committee launched a scheme of "Grow More Lac" to combat declining production. A Special Officer for Lac Cultivation was appointed in November 1951 to organise and run this scheme as also the Intensive Demonstration Scheme.

To help the cultivators, co-operative societies are proposed to be formed through which assistance is to be provided.

Utilisation of shellac within the country

With regard to increasing utilisation of shellac within the country and assisting manufacturers of shellac, a Lac Information Officer was appointed at the Indian Lac Research Institute in 1945 for dissemination of scientific information and providing technical assistance to the manufacturers and consumers of shellac in the country.

Country crop forecasts and statistics

One of the important recommendations of the Lindsay-Harlow Report was that periodical forecasts of the crop should be published. Whereas in the case of other commodities the State Governments have extensive machinery for preparing forecasts of production, for lac the only agency doing this work is the Indian Lac Cess Committee. In addition, the Committee is also maintaining comprehensive statistics of production and trade.

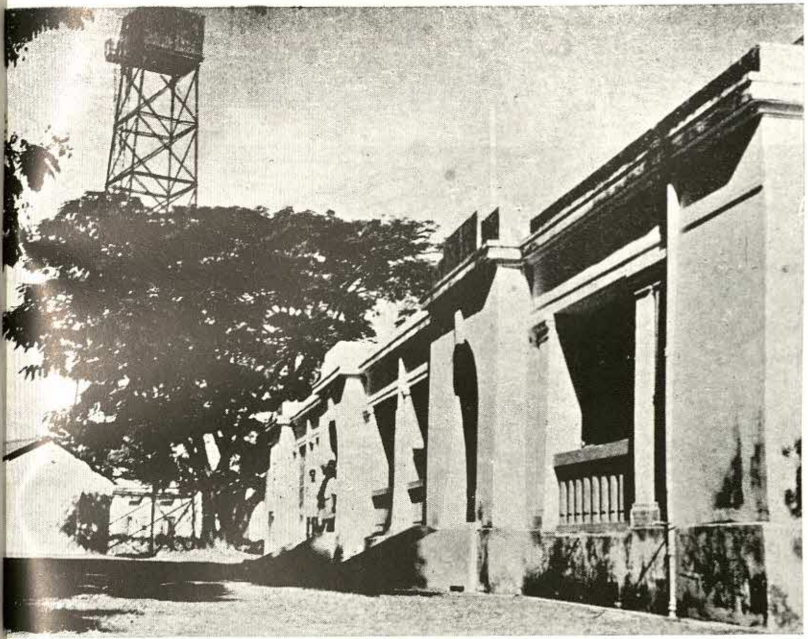
Measures for improvement of marketing

The functions of the Committee in relation to measures for improving marketing of lac are mainly advisory.

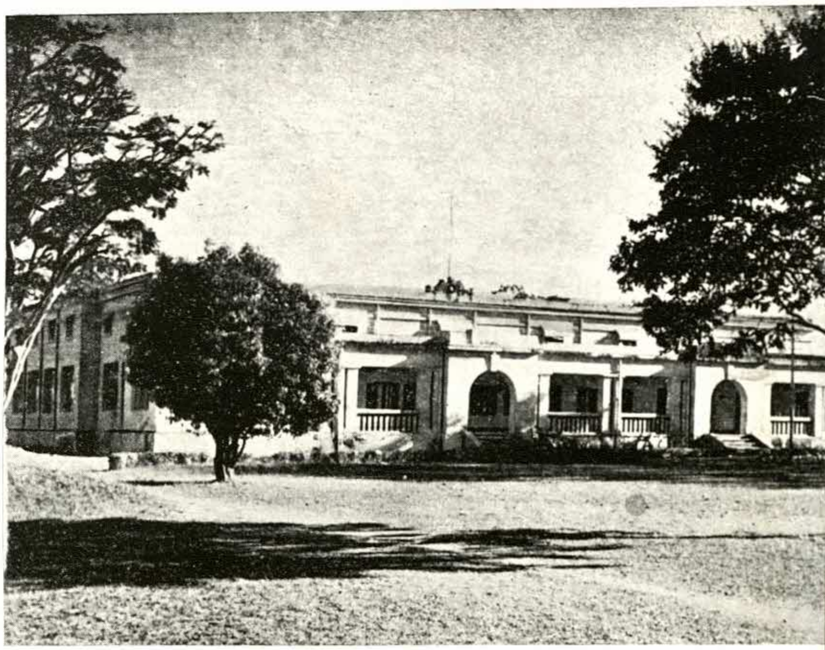
In 1937, the Committee decided to carry out a marketing survey for lac in all its forms. The work was later entrusted to the Agricultural Marketing Adviser to the Government of India, and was completed in March, 1940. The Report was published in 1943. This report is now under revision.

Lately, the Committee has given pointed attention to matters relating to marketing. The proposals considered by the Committee relate to the banning of forward trading, formation of a Lac Board which might take over the entire export trade, and fixation of floor and ceiling prices of seedlac and shellac for export purposes. On the recommendation of the Committee, the Government of India adopted measures to regulate speculation and banned forward trading in seedlac and shellac from December 1954.

In the Second Five-Year Plan, proposals have been made for establishing air-conditioned godowns, sticklac warehouses and analytical laboratories. Another important activity concerns the standardisation of seedlac, shellac and bleached lac. All these measures will greatly assist in improving the marketing of lac.



Chemical Laboratory, Lac Research Institute, Ranchi

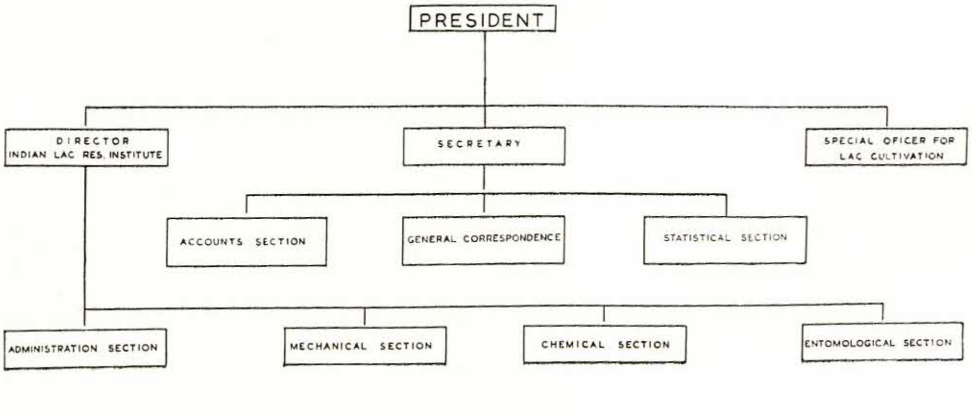


Entomological Laboratory, Lac Research Institute, Ranchi

INDIAN LAC CESS COMMITTEE

Headquarters—Ranchi (Bihar)

Organisation Chart



INDIAN LAC RESEARCH INSTITUTE

Namkum (Bihar)

THE Indian Lac Research Insitute is situated at Namkum, about six miles away from Ranchi, the summer capital of Bihar. It was established in 1925 by the Indian Lac Association of Research, a private registered body of merchants. Later, in conformity with the pattern of commodity research suggested by the Royal Commission on Agriculture in 1928, the management of the Institute was handed over in 1931 to the Indian Lac Cess Committee. Since its very inception, lac research has been financed through the levy of a cess on all exports of lac. This cess, as already mentioned, has been revised from time to time to meet the growing needs of the Institute and of the expanding work of the Committee.

The laboratories of the Institute consist of three fair-sized separate buildings, housing the Chemical Laboratory, the Entomological Laboratory and the Experimental Factory. The Institute is headed by its Director, who also functions as Chief Chemist for the Chemical Section. The present staff on the research side is 36 in number, including two Scientific Officers in the Chemical Section, and an Entomologist, a Biologist and a Scientific Officer in the Entomological Section.

The Institute's main activities centre round research. But, for a fairly long time, it has also been doing considerable work on the dissemination of the results of research. Thus, until the end of 1948, it had conducted an extensive lac demonstration campaign. It was also working out several schemes in collaboration with State Governments till 1951. This work, because of its growing magnitude, has been transferred to a newly created separate wing under the Committee. At present the Institute has its Shellac Utilisation Officer (formerly designated as Lac Information Officer) who publicises and demonstrates practical advances in lac technology. The Institute also imparts training in lac cultivation and in the industrial uses of lac.

ACHIEVEMENTS IN RESEARCH

Originally, research was directed primarily towards evolving improved methods of cultivation ; hence entomological and allied studies, e.g. biochemical investigations on the lac insect and the interaction between it and the host trees, were given greater attention. With the passage of time and the impact of new forces in its wake, the emphasis has gradually shifted to other aspects, particularly chemical and chemo-technical studies with complete termination of the bio-chemical investigations.

The results of research work done at the Institute may conveniently be grouped under two categories, entomological and chemical, the latter comprising physical, physico-chemical and applied research also.

Entomological research

Lac is a resinous secretion from the glands of a bug-like insect called *Laccifer lacca*, Kerr. It lives as a parasite on certain species of plants called lac hosts, whose sap serves as its food. Right from its larval stage, it inserts its proboscis into the bark of its host, and goes on sucking sap and secreting lac all round its body till it dies ; lac really forms a protective covering for the insect. The insect, except for the male in the last phase of its life which is spent in procreation, is immobile, spending its entire life alone in the lac cell built by its own secretion. The cells, however, lie very close to one another and generally coalesce, presenting the appearance of continuous lac encrustation.

For practical purposes, two strains of the lac insect may be distinguished, the *Kusumi* and the *Rangeeni*, the former living and thriving only on *Kusum* (*Schleichera oleosa*), and the latter on hosts other than *Kusum*, namely, *Ber* (*Zizyphus mauritiana*), *Palas* (*Butea monosperma*), *Ghont* (*Zizyphus xylopyra*), *Jallari* (*Shorea talura*), *Arhar* (*Cajanus cajan*), etc. There is just one plant, *Khair* (*Acacia catechu*), which will sustain either strain. Both the strains complete two cycles of life annually (with the exception of *Rangeeni* strain on *Shorea talura* in South India, which completes three life cycles in about 13 months, but behaves normally on the same host in Chotanagpur), and corresponding to each life cycle, one lac crop is obtained. There are, therefore, four lac crops in a year, viz. two *Kusumi*, and two *Rangeeni*. While the two life cycles in the case of *Kusumi* are more or less of equal duration, those for *Rangeeni* are very unequal, one being nearly double the other. The two *Kusumi* crops are *Jethwi* (January-February to June-July) and *Aghani* (June-July to January-February). The *Rangeeni* crops are *Baisakhi* (October-November to June-July) and *Katki* (June-July to October-November). The period for each crop to mature represents one life cycle.

It is clear that successful lac cultivation requires the study of, and attention to, (i) the insects which have to be reared in a healthy condition, (ii) the host trees which are to provide food and shelter to them, and (iii) the enemies, particularly insect enemies, which have to be controlled. Inclement weather is also a great deterrent to lac cultivation, and has to be guarded against or circumvented somehow.

The results of investigations relating to the various aspects of lac cultivation are described below.

Broodlac and lac cultivation

Each female inhabiting a cell, when mature, lays eggs which eventually give rise to larvae. These larvae, shortly after they hatch out from the eggs, start coming out through an opening in the mother's body (anal region of the lac cells). Each female may give birth to some 1000 larvae, the average number being 200-500 per female. Since a lac-encrusted stick (to be called a piece of sticklac) even when only a few inches long, will contain enormous numbers of the cells, the number of larvae emerging is very large and covers the stick as a crimson powdery fluff made up of minute soft-bodied creatures (0.6 mm. long and 0.2 mm. across), crawling all the time in search of new habitat. This large emergence of larvae is called "swarming", and the lac sticks in which swarming takes place or is about to take place are called broodlac. Lac cultivation essentially involves tying these bits of broodlac on to branches of (prepared) host trees, on which the larvae coming out of their mother cells, settle and start a new generation. This tying of broodlac to fresh hosts is called 'infection'. Broodlac is the most important item in lac cultivation, and unless it is mature and healthy, the progeny would be weak and devitalised, and would either not survive or produce very little lac. It is, however, difficult to judge as to when lac is mature, i.e. when swarming is yet to take place. Microscopic examination, no doubt, may determine the correct stage of development, but that is no help to the cultivators. The Institute has found out a visual method by which it is possible to forecast emergence with a fair degree of accuracy. Briefly stated, the method is as follows: the part of the lac cell near the anal region of the mother insect looks orange yellow at maturity, and occupies about one-fourth of the surface-area of the cell five days before swarming, and about one-third of the area three days before swarming. Broodlac may be cut about this time, i.e. any time within this period of three days before swarming, if, in particular, broodlac has to be transported over long distances. Broodlac for local use may be cut even after emergence has started.

A point of special interest to note is that air-transport of broodlac over long distances could be effected with success several times because of the accuracy in forecasting dates of emergence. This has helped in extending lac cultivation all over the country.

Storage of broodlac requires careful attention. It should be kept in well-ventilated, cool rooms or shade, and must not be exposed to rain or moisture, nor kept in closed baskets or sacks, as this often leads to growth of fungus over the anal openings, which impedes free emergence of larvae.

Preservation of summer broodlac

Obtaining broodlac from the *Rangeeni* summer crop (*Baisakhi*, October-November to June-July) which matures in June-July is a matter of difficulty. The hosts concerned are deciduous and shed their leaves mostly in summer; and the lac is thereby exposed to the scorching summer heat which results in high mortality of insects. This explains why the crop is harvested mostly in *Baisakh* (April-May) and rarely in June-July. The fact that broodlac cannot be obtained from immature lac is responsible for a reduced *Katki* crop and, often, its complete failure. This problem has been solved in a number of ways: (i) partial pruning of *Ber*: If *Ber* is partially pruned just before infection in October or after infection in December, premature growth of new leaves takes place in summer, which affords the necessary protection to the crop; (ii) artificial partial defoliation of *Palas*; if *Palas* is artificially partially defoliated before infection in October-November, new leaves appear before the advent of summer which shield the crop from the sun and the hot winds (defoliation, incidentally, also effects a saving in broodlac), and (iii) a few lac hosts, e.g. *Albizzia lucida*, *Ficus bengalensis*, *Ougeinia dalbergioides* may be infected to carry the summer crop from which broodlac may be reaped in June-July.

Winter brood from *Kusum*

Kusum being an evergreen tree, does not present the problem of summer brood from the *Jethwi* crop. But, sometimes a spell of unusually cold weather, made worse by continuous rainfall in winter (January-February) prevents emergence of lac larvae, which may ultimately die in the mother cells. To overcome this difficulty, sticks of broodlac are kept in a warm room near fire-places at night when emergence ensues; the sticks thereafter tied on to trees, effect good infection. The process, termed 'forced swarming', may, however, have to be repeated several times till complete emergence results or the weather improves.

Alternation of brood

As may be expected, broodlac rom one species of host used to infect a different species has a marked invigorating effect on the progeny. While the large variety of the *Rangeeni* hosts makes it easy for different hosts to be provided in their case, the problem is somewhat difficult for the *Kusumi* strain which thrives practically on *Kusum* alone. Systematic research has revealed, however, that *Khair* is another host, besides *Kusum*, which will sustain the *Kusumi* strain and may, hence, be utilized for providing an alternative host. Experience shows that *Khair* should be used for growing only the *Katki* or the *Aghani* crop, and not the summer crop.

Treatment of lac hosts

Food supply to the lac-insects can be adequate only if the trees are healthy and have plenty of soft, succulent shoots. Pruning at the appropriate time and in a correct manner ensures this. It may be noted that pruning as practised by the cultivators is very heavy, being often pushed to the limit of pollarding. Experiments show that pruning should be light, only branches not thicker than one inch in diameter being cut. Pruning is essential when hosts are brought under lac cultivation for the first time ; thereafter careful harvesting (cutting ofcrop) renders further pruning unnecessary. Pruning should not cause splitting or laceration. Special instruments have been designed for the purpose. The appropriate times for pruning are, for the *Rangeeni* hosts, first half of April for infection in October-November, and the first half of February for infection in July ; *Kusum* trees pruned in January-February become fit for infection about 1½ years after pruning.

Compact areas of trees may be divided into coupés in order that the trees may get adequate rest, and self-infection may be avoided. Experiments show that the best results are obtained by dividing the *Ber* and *Palas* hosts into three coupés with host numbers in the ratio 1 :3 :3 ; the smallest coupé should have one big coupé on either side, and should be infected every year for the *Katki* crop only. The two large coupes should be used to grow only the *Baisakhi* crop in alternate years, broodlac for which should be provided by the *Katki* coupé. The *Baisakhi* crop from the large coupés should be harvested in June-July, when such branches as are sparsely covered with living lac should be left uncut for self-infection of the coupé for the succeeding *Katki* crop. Complete harvesting should be done in October-November to obtain the *Katki* crop to be used as brood for the *Baisakhi* crop. In hot areas, the trees may be divided into two coupés only. The *Kusum* trees may be divided into four equal coupés, one coupé only being used once in every 1½ years for any crop : this ensures 1½ years' rest to each coupé.

Enemies of lac and their control

Insect enemies of lac, accounting for 30-40 per cent loss of the total crop, are of two kinds, parasites and predators. The former are *Chalcids*, which lay their eggs inside the body of the lac insect ; the larvae of these feed on, and kill, the insectcts eventually. The most important ones are *Eublemma amabilis*, a white moth, and *Holcocera pulverea*, a blackish grey moth. Control methods devised so far are both cultural and artificial, and are briefly mentioned below.

Cultural and artificial methods of control

Extensive studies have shown that broodlac is the principal source of predators and parasites of the lac insects. This is primarily due to the fact that these enemy insects grow side by side with lac insects and at their expense. Hence, proper care in the selection and handling of broodlac is essential in combating the enemy insects. The following means have been found very useful for this purpose :

(a) Infested samples of broodlac should be avoided ; the presence of such infestation is usually shown by a number of holes on the surface, which are bigger than the head of a pin.

(b) Broodlac should not be kept tied on to the branches of the host trees for more than 2-3 weeks, as after this period, enemy insects also start coming out, ready to attack afresh.

(c) Broodlac should be encased in 60-80 mesh (brass) wire-gauze containers about 12 inches long and 3 inches in diameter. Such containers allow free exit to the lac larvae, while keeping back the enemy larvae.

(d) Simultaneous cultivation of early-maturing and late-maturing lac in the same locality should be avoided, because enemies emerging from the former attack the latter, and thus the two varieties, between them, serve as perennial source of food supply to them. It follows that growing *Rangeeni* crop in predominantly *Kusum* areas and *vice versa* should be avoided.

Self-infection should be avoided as far as possible. Self-infection, while weakening the progeny of lac, is the most potent factor in the perpetuation of the lac enemies.

Biological control

Mention has been made of *Eublemma amabilis*, a predator of lac insects. This, in fact, is the most important enemy of lac and accounts for more than half the total damage. A natural enemy of the insect *E. amabilis* has been discovered in *Bracon greeni*, which has, therefore, been sought to be bred in large numbers in the laboratory for being released in field areas. The most promising alternative hosts of *Bracon greeni* so far appear to be *Amaltas* pod borer (*T. fructicassiella*) and *Crotalaria juncea* pod borer (*Etiella zinkenella*).

Various other problems are being tackled, e.g. (i) optimum larval settlement on various hosts during infection, (ii) growing of lac hosts under bush and crop conditions, and (iii) pests of host trees and their control.

CHEMICAL RESEARCH

Bio-chemical investigations that preceded regular chemical-*cum*-physico-chemical work on the fundamental and applied side, established *inter alia* the need for calcium as an important manure element for hosts, and the usefulness of their triangular spacing. In addition, valuable data on the secretion of lac from different hosts in various seasons, the *p*H of tree saps, etc. were also collected.

The basicity and molecular weight of shellac and its constituents have been determined. The extent of unsaturation present has been determined by two new methods, namely, by catalytic hydrogenation, and the use of tolyliodo-chloride. The optical, thermal and electrical properties, e.g. refractive index, specific heat, dielectric properties, light scattering, etc. have been studied. The results obtained have not only thrown considerable light on the performance and limitations of shellac, but have also provided some clues helpful for overcoming them. The dielectric studies, for instance, have clearly brought out the role of moisture in lac. The study of solutions, dilute as well as concentrated, has led to outstanding results, which have proved to be of great importance in the entire field of resin or high-polymer chemistry. Thus, studies on viscosity, dialysis, osmotic pressure, etc. conclusively proved that shellac undergoes molecular dispersion in solution, and that its seemingly colloidal behaviour in concentrated solutions is to be attributed to its tendency to form solvated clusters with large surfaces. The study eventually resulted in the formation of the concepts of ' mixed solvents ' for shellac, which explained many long-standing anomalies, e.g. precipitation on dilution. The solvating tendency in its turn could be traced back to the composite character of shellac molecules, that is, presence in it of both polar and non-polar groups, a fact which was very well brought out in dielectric studies also. The study of the constitution of shellac has resulted in the separation and isolation of several acid constituents, one of which has been identified and designated as butolic acid. Thermal polymerisation of aleuritic acid, an important degradation product of shellac, has been studied. Viscosity and other studies have served to determine the activation energies for various constituents such as soft resin, hard resin, and axial ratios from depolarisation data, etc. Pure lac dye has been prepared from the concentrated wash, (liquor obtained in the course of sticklac washing) and its possible use as a cochineal substitute examined.

Analysis and grading

Considerable work has been done on evolving agreed specifications and standards, and tests ancillary to them. The Indian Standards Institution, in close collaboration with the Indian Lac Research Institute and the International Organisation for Standards, has drafted standards regarding bleached lac, seedlac, shellac and sealing wax, which are awaiting finalisation.

Processing and manufacture

Seedlac of improved colour or quality has been prepared by using triethanolamine in the course of sticklac washing. Being a costly chemical, this has recently been successfully replaced by caustic soda with which equally good products have been obtained. The autoclave process of lac melting has been found to be adaptable to both small- and large-scale operations. It dispenses with shellac cloth and charcoal, two costly materials, in the country process for manufacture of shellac. It also requires less labour. All these make the process much cheaper. A shellac or sheet making machine, capable of sheeting 2 lb. of molten lac in five minutes, has been devised as also a mechanical method for the separation of sand from seedlac.

Moulding compositions

Thermo-setting moulding compositions have been made by modifying lac with urea and formaldehyde, which, when admixed with wood fillers, etc. can be successfully worked on compression moulding technique. Similarly, by using fibrous fillers, etc. compositions suitable for injection moulding have been obtained.

Varnish, paints and lacquers

The age-old spirit varnishes have been improved in regard to water resistance, elasticity, and adhesion of films by pre-treatment of lac with small amounts of chemicals like urea, maleic anhydride etc., condensation of lac with urea and formaldehyde, incorporation of small amounts of spirit-soluble nitrocellulose, and condensing lac with cashewnut shell liquid. Results, entirely new and with immense possibilities, have been achieved in the field of lac-oil varnishes, paints, etc. Lac had a very restricted application as an ingredient of oil varnish because of its incompatibility with linseed oil. As a result of considerable research, several ways have been found to obviate this difficulty.

Adhesives and cements

Various lac-based adhesives or cements have been formulated, some of which are in commercial use, e.g. for making water-proof grinding wheels, micanite, V-Rings, laminated paper, hessian boards, etc. A bulb-capping cement, working satisfactorily for bulbs of up to 100 watts, and also useful in mending broken porcelain apparatus and utensils, has been formulated. Water-white adhesive, based on aleuritic acid, having many possibilities has also been prepared.

RESEARCH SCHEMES FINANCED BY THE INDIAN LAC CESS COMMITTEE

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned (Rs. in lakhs)	Objectives	Achievements	Remarks
Intensive demonstration of improved methods of lac cultivation	Bihar W. Bengal, Madhya Pradesh, Uttar Pradesh, Bombay	16 years (1942-58)	3.56	Dissemination of results of research	Orthodox cultivators are adopting improved methods of lac cultivation	Scheme current
Extension of cultivation of lac in forest and other areas	In all States		1.25	To increase production of lac	Areas where lac cultivation can be extended have been surveyed	
Organisation of lac growers' co-operative societies	Bihar	4 years (1954-58)	0.11	To prevent of theft of lac		do.
Cultivation of lac in forest areas	Bihar	12 years (1942-54)	0.09	To demonstrate that lac can be profitably grown in forest areas	In years of normal seasons, lac could be successfully cultivated, but repeated bad seasons resulted in the failure of the scheme	
Utilisation of shellac	—	11 years (1935-46)	1.18	To study the uses of lac and lac products in electrical insulations	A spraygun for spraying hot molten shellac (solventless coating) designed	Work done by Metropolitan Vickers Electrical Co. Ltd., Manchester, London
Utilisation of shellac	—	3 years (1936-39)	0.12	To study the use of lac in the rubber industry	Lac useful as a thermoplastic resin and in vulcanisation of rubber	Work done by Research Association of British Rubber Mfrs., London
Utilisation of shellac	—	5 years (1934-39)	1.21	To carry out scientific work to secure the larger use of lac in American industries	Scientific studies on certain well known applications, e.g., shellac and nitrocellulose laquor were made	Work done by United States Shellac Importers Association New York
Styrenstion of shellac	Indian Association for the Cultivation of Science, Calcutta	3 years (1956-59)	0.31	To study the constitution of lac	—	Scheme current
Research on lac dye	Bombay University	3 years (1956-59)	0.18	To determine fully the structure of dye and possibility of utilising the dye	—	do.
Establishment of Regional Field Stations	West Bengal, Bihar, Madhya Pradesh and Uttar Pradesh	3 years (1957-60)	7.00	To study regional problems pertaining to different aspects of lac cultivation and entomology with a view to improving and extending its cultivation	—	do.
Setting up of regional testing laboratories	Bihar, Madhya Pradesh and Uttar Pradesh	3 years (1957-60)	3.00	To analyse samples of shellac and seedlac	—	do.

INDIAN CENTRAL SUGARCANE COMMITTEE

Headquarters—New Delhi

THE Indian Central Sugarcane Committee was constituted by the Government of India in November 1944, as a body corporate and was registered to undertake improvement and development of sugarcane, *gur*, sugar and other bye-products.

Later, consequent on the formation of the Development Council for Sugar Industry under the Industries Development and Regulation Act, 1951, the Government of India in the Ministry of Food and Agriculture reconstituted the Indian Central Sugarcane Committee divesting it of the functions relating to the technology of sugarcane, but entrusting it with research and development of sugarcane and *gur*. The development of *gur* has been entrusted to the All India Village Industries and Khadi commission. The headquarters of the Committee have been located at New Delhi.

Functions

The technical programmes of all sugarcane research investigations and some extension work in the country are approved by the Committee.

The Government of India contributes an annual grant of Rs. 8.0 lakhs to the Committee for its activities. The Committee utilises the grant for the following:

(i) Sugarcane research schemes
(ii) Campaigns for intensive manuring of sugarcane
(iii) Schemes on the cost of cultivation of sugarcane in various important States
(iv) Administration, organising conferences and publications of sugarcane journal

Additional amounts are provided for research on *gur* schemes. For schemes relating to sugarcane development and improvement in sugarcane cultivation, etc. approved by the committee, separate funds are provided by the Government of India, the amounts depending on the demands of the States operating such schemes on behalf of the Committee.

The Indian Central Sugarcane Committee subsidises the research schemes on a 50 : 50 basis of pay and all allowances of the staff in the States and fully the schemes under the Central Institutes such as the Sugarcane Breeding Institute, Coimbatore and the Indian Institute of Sugarcane Research, Lucknow, the I.A.R.I. New Delhi and the Meteorological Offices at Poona.

ORGANISATION

The Indian Central Sugarcane Committee is constituted as follows:

1. President nominated by the Government of India
2. Agricultural Commissioner with the Government of India
3. Director, Indian Agricultural Research Institute, New Delhi
4. Director, Indian Institute of Sugarcane Research, Lucknow
5. Director, Sugarcane Breeding Institute, Coimbatore

6-12. Directors of Agriculture in Andhra Pradesh, Bihar, Bombay, Madras, Mysore, Punjab and Uttar Pradesh
13-15. Cane Commissioners in Bihar, Punjab and Uttar Pradesh

16-26. Eleven non-official representatives, one each from Andhra Pradesh, Assam, Bihar, Bombay, Madhya Pradesh, Madras, Mysore, Orissa, Punjab, Uttar Pradesh and West Bengal

27-29. Three non-official representatives of gur and khandsari interests (nominated by the Central Government)

30-32. Three Members of Parliament—two from the Lok Sabha, and one from the Rajya Sabha

33-35. One representative each of the Ministries of Finance and Railways and of the Development Council for Sugar Industry

36-38. Any additional members as the Central Government may appoint from time to time subject to a maximum of three

The Committee operates through various Sub-Committees which scrutinise technical programmes and progress reports of schemes. The Sub-Commitees are:

1. The Agricultural Research Sub-Committee
2. The Gur and Khandsari Sub-Committee
3. The Entomological Sub-Committee
4. The Mycological Sub-Committee
5. The Finance and Executive Sub-Committee

Besides the five committees, there are two *ad hoc* sub-committees for cost of cultivation and assessment of development work.

ACHIEVEMENTS

Plant Breeding and Botany

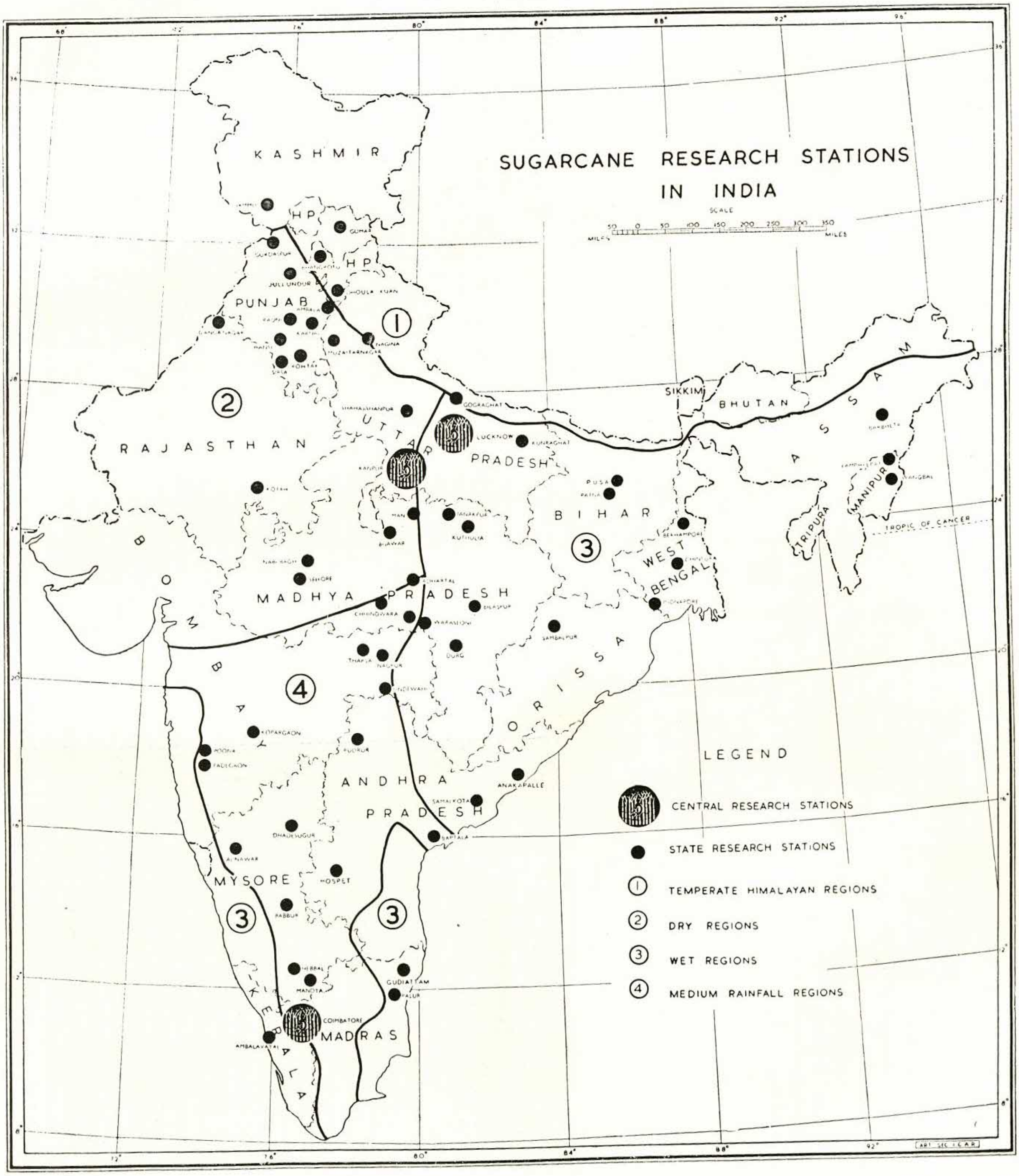
Evolution of improved sugarcane varieties has been the main work of the Sugarcane Breeding Institute, Coimbatore, since its inception. It has aimed at producing varieties combining high tonnage and juice quality, tolerance to adverse conditions of growth and resistance to pests and diseases. The development of pith and cavity, largely a varietal feature, was found to be affected by several external factors. Studies on the association of plant characters with insect pests have led to the formulation of distinct morpho-anatomical criteria for resistance or susceptibility to pests.

Agronomy

In the South, such outstanding cane varieties as Poovan and Vellai have been completely replaced by Co. 419 which has come to be recognised as a wonder cane. It yields from 40 to 90 tons of cane per acre and contains 13-16 per cent sugar. It is spreading towards north-eastern parts of the country, and has covered a considerable portion of the cane areas in Orissa, Bengal, and Assam, as also certain tracts in Bihar. In the sub-tropical belt of Northern India, Co. 312 and Co. 421 have proved very successful. The new variety Co. 453 has been found to be an outstandingly high yielder, while Co. 527 is a mid-early ripening high-yielding variety. Further, selections made locally from seedlings received from Coimbatore, such as Co. L.9, Co.S.109, Co.S. 245, Co. S. 321 and Co. S.416 are giving good performance, the first named in the Punjab and the rest in U.P. In the State of Bihar, the local releases B.O.10 and B.O. 11 have made their mark, and cover extensive acreage in the sugarcane tract. B.O. 10 has shown exceptional field resistance to red-rot disease, while B.O. 11 has established a record for sugar per acre in the sub-tropical North, particularly in Bihar and adjoining areas.

Manurial doses vary largely in different parts of the country, a heavy nitrogenous dressing (300-450 lb. N. per acre) is applied in Bombay while a lighter dose (200-300 lb. per acre) in Madras. Both the States come under the tropical region and produce high tonnage of crop. In the

[PLATE LXI



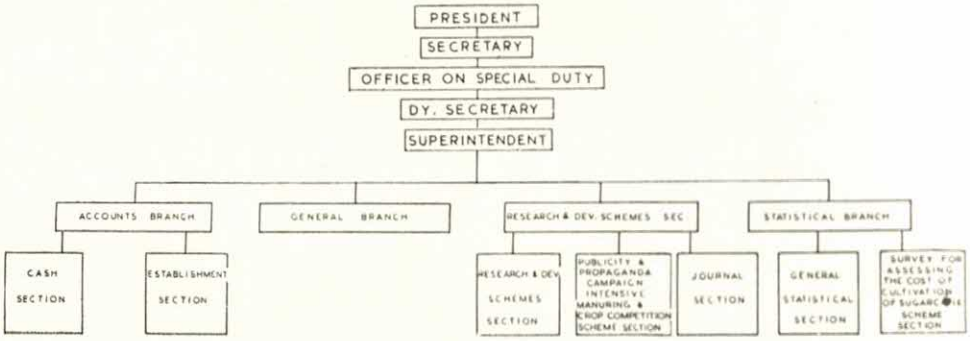
SUGARCANE RESEARCH STATIONS IN INDIA

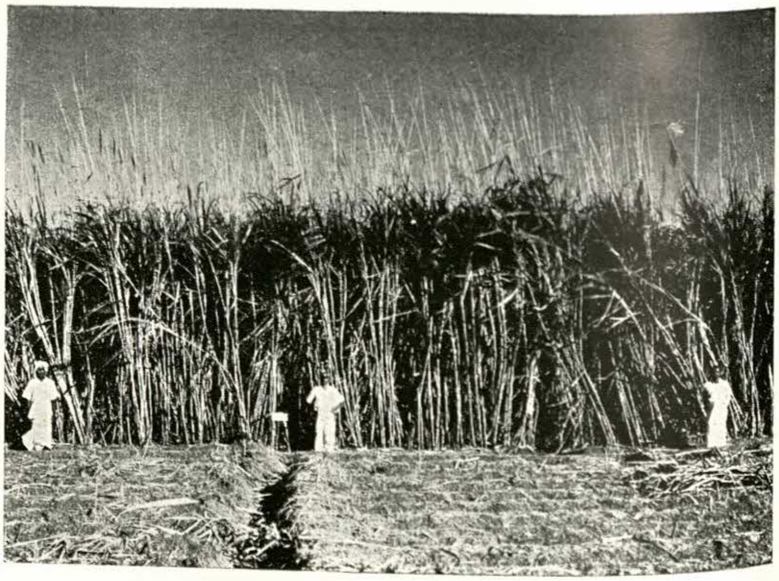
[Plate LXII

INDIAN CENTRAL SUGARCANE COMMITTEE

Headquarters—New Delhi

Organisation Chart


PRESIDENT
SECRETARY
OFFICER ON SPECIAL DUTY
DY. SECRETARY
SUPERINTENDENT
ACCOUNTS BRANCH
GENERAL BRANCH
RESEARCH & DEV. SCHEMES SEC
STATISTICAL BRANCH
CASH SECTION
ESTABLISHMENT SECTION
RESEARCH & DEV. SCHEMES SECTION
PUBLICITY & PROPAGANDA CAMPAIGN INTENSIVE MANURING & CROP COMPETITION SCHEME SECTION
JOURNAL SECTION
GENERAL STATISTICAL SECTION
SURVEY FOR ASSESSING THE COST OF CULTIVATION OF SUGARCANE SCHEME SECTION



A good crop of sugarcane variety Co. 419, which yielded over 100 tons of cane per acre near Coimbatore

sub-tropical North, Nitrogen doses are between 120 and 200 lb. per acre under irrigated conditions, and about 100 lb. per acre under unirrigated conditions. Phosphatic applications are restricted to parts of Bihar and Bombay, since responses to applications of phosphatic manures have been noted only in those areas.

The most important cultural improvement has been a shift in the planting date so as to increase the growth span of the crop and thus step up its tonnage and quality. Peninsular India has largely switched over from the older practice of *eksali* (12 months) planting to *adsali* (18 months). Similarly, in North India, a rapid change over from spring to autumn planting is taking place. The benefit consists in a much higher tonnage with substantial improvements in quality. Means have also been devised for raising production by other cultural methods such as by reducing the distances between and within the rows, and by adoption of a new procedure of stubble harvesting consisting of digging the cane instead of cutting it at the surface. Weed control by 2,4-D and MCP has also been achieved.

Irrigational requirements of sugarcane under controlled conditions have been determined at the Sugarcane Research Stations in the U.P., the Punjab and Bombay. In U.P., 5-6 irrigations in the western, 4-5 in the central and 3-5 in the eastern regions were found to be the normal requirements of the crop during pre-monsoon period, each irrigation being about 4 acre-inches of water per acre. In the Punjab, a total of 70-75 acre-inches of water were found to be optimum. In Bombay, 95 acre-inches were found to be the optimum requirements of water for the cane plant '*eksali*' and 115 acre inches for '*adsali*' crop.

Chemistry of cane

The hand refractometer has been used in the Indian industry with fruitful results. Among its important applications may be mentioned the evaluation of juice quality in standing cane by refractometer survey for which dependable procedure has been developed. This has enabled pre-determination of crushing schedule leading to substantial enhancement in sugar recovery.

Chemistry of *gur*

The nature of *gur* and its formation have been elucidated in the light of physico-chemical theories. A considerable amount of work has been done with regard to the effect of juice composition on quality of the product, the adverse role of various non-sugar constituents, both organic and inorganic, being brought out in this connection. Manurial and cultural treatments have been shown to influence the non-sugar status, suggesting a means for improving the quality of *gur* from varieties inherently poor in this regard. The problem of juice clarification in *gur* manufacture has also been studied, notable advances being the use of activated paddy husk carbon and the evolution of a cheaper and more effective method of clarification with the extract of castor seeds or groundnut or of a readymade tablet made from soyabean flour with traces of mono-calcium phosphate. Work on *gur* storage has resulted in the evolution of several methods suitable for conditions in villages, large markets and transport, which protect the stored product from liquefaction and deterioration during the rainy season. Studies on the nutritive value of *gur* have indicated its superiority over sugar. Work on cane crushers and juice boiling furnaces for the *gur* industry has produced a number of improvements with regard to both.

Soil survey

Studies of sugarcane soil characteristics have constituted a major item of research in the States of Bombay, U.P. and Bihar. The Bombay work began with the classification of black cotton soils of the major canal tracts into twelve distinct types on the basis of topography, drainage and sub-soil water table and this has been followed by a rapid test survey of the soil types and preparation of maps showing physical properties and nutrient status. In U.P. the classification of the sugarcane soils into three major types has been effected along with further sub-division into lower category levels of texture and phase. In both the States, extensive crop cutting and manurial experiments have been carried out on different soils for assessing their manurial requirements. In Bihar, five broad soil divisions have been recognised in the sugarcane growing areas based on variations of climate.

Sugarcane entomology

Although it was realized for the last twenty years or so that insect pests cause colossal losses to sugarcane, the systematic position of some of them was not clear until recently. The morphology and biology of the various important pests have been worked out in detail especially in the case of termites. The influence of climatic conditions on the pest population has been exhaustively studied, and sampling technique evolved for estimating the incidence of borers, pyrilla, white-fly and mites. In the field of borer control, mechanical measures such as collection of egg masses and adults, cutting out dead hearts, killing of live larvae by spindle thrust and early earthing are successful as well as the biological control by *Trichogramma* under limited conditions. The discovery of new insecticides has, however, for the time being at least, relegated these methods into the background, for the results of chemical control have been quite spectacular in the case of both whitefly and pyrilla where D.D.T., B.H.C. and Endrin have proved admirably successful and in the case of borers, Endrin is showing some promise. Similarly, control of termites can be effectively secured by treatment of setts in furrows with Aldrin and Dieldrin, the protection afforded lasting over a year. Besides the above, a number of minor pests such as grass hoppers, ' hispa ', black bugs, thrips, aphids and mites prove amenable to chemical control with one or the other of various insecticides, such as D.D.T., B.H.C., Aldrin, Dieldrin, etc.

Sugarcane mycology

Red-rot is the principal disease of sugarcane in the sub-tropical India. A certain amount of information has become available with regard to the growth and longevity of the pathogen. The physiology of the fungus has not received adequate attention so far.

Wilt of sugarcane is a disease often occurring in association with red-rot, and under these conditions, it causes much greater damage to the crop than either of the diseases occurring alone. It has been possible to produce typical symptoms of wilt by soil inoculation in the vicinity of artificially injured roots and by growing healthy plants in infected soil.

Smut disease is also important which has more than once necessitated large-scale control measures consisting of eradication of diseased clumps and replacement of the susceptible variety.

SUGARCANE BREEDING INSTITUTE

Coimbatore (Madras State)

THE Sugarcane Breeding Institute at Coimbatore was established in 1912 with the aid of funds provided by the Government of India. The Breeding Station was located at Coimbatore since cane varieties were found to flower and set seed freely at this place. At its inception, the Station was under the administrative control of the Director of Agriculture, Madras. The Government of India took over the Station in 1924, and until 1950, it formed a part of the Imperial, (now Indian) Agricultural Research Institute, Pusa, New Delhi. With the taking over of the Station directly by the Ministry of Food and Agriculture, in 1950, it was set up as a full-fledged Institute.

ORGANISATION

The Institute is headed by a Director and has six research sections dealing with different aspects of cane improvement. These Sections are Breeding and Botany, Cytogenetics, Physiology, Chemistry, Mycology and Entomology. Inaddition, some staff has also been provided for the statistical and meteorological investigations. The Institute has a Substation in the sub-tropical region at Karnal, Punjab.

The functions of the Institute are as given below:

(1) to develop improved sugarcane varieties for all the cane tracts of the Indian Union,
(2) to conduct fundamental investigations on the botanical, cyto-genetical, physiological, chemical, mycological and entomological aspects of sugarcane and
(3) to impart post-graduate training in the breeding and botany of sugarcane.

Ever since its inception, the Institute has been actively engaged in the evolution of improved varieties for sub-tropical regions of India and since 1926, for the tropical parts also. This has involved the use of various species of *Saccharum* and in some cases related genera in the breeding of new varieties. Much improvement in technique has also been effected over the last four decades.

A large number of crosses are annually effected between carefully selected breeding canes. Every year about 80,000 seedlings are raised. A rigorous selection is made among the seedings of each annual batch for over 3 to 4 years on the basis of agricultural and commercial qualities, and canes from seedings finally retained are sent out for testing to Sugarcane Research Stations in the various States in the Indian Union. Those which show distinctly superior performance in the States are released for general cultivation. Newer and better varieties are thus sent out constantly from Coimbatore to replace the older ones. The improved Coimbatore canes now occupy 90 per cent of the sugarcane area in the Union. Six of the main varieties in cultivation are Co. 312, Co.313, Co.419, Co.421, Co.453 and Co. 527.

The success achieved in the production of improved varieties of cane especially for sub-tropics has been largely due to the employment of the *Kans* grass, wild sugarcane (*Saccharum spontaneum*), as a parent in hybridisation. This wild cane confers many desirable characters like hardiness, vigour, disease resistance, etc. on the progeny, and this species has been, therefore, studied in detail. A large number of varieties of this species has been collected from the various parts of the Indian Union and from almost all the countries of the tropical and sub-tropical Asia and Africa. Work is in progress to understand the variation pattern in the species, and the breeding value of the variants as parental stocks is being assessed.

A world collection of sugarcane consisting of hundreds of cultivated cane varieties from Melanesia, Indonesia and other parts of the world has been established at the Institute. This provides a vast store of desirable breeding material for use in breeding of canes for different requirements and regions.

Cytogenetical studies have shown that sugarcane is a highly heterozygous polyploid complex. Certain peculiarities like diploid parthenogenesis, elimination of chromosomes *en bloc*, non-segregation of parental characters due to auto-syndetic pairing, have been noticed. Work has been in progress to understand the genetical constitution of *S. Officinarum*.

For improving the range of crossing, it is necessary that non-flowering varieties should be made to flower and the flowering time of varieties should be controlled. This problem is being tackled in the Physiology Section. A substantial degree of control over the time of flowering in several varieties has been obtained through a series of photoperiod experiments. Marked varietal differences in response to various photoperiodic treatments have been observed. Plants can now be rendered vegetative by extra light treatment and brought to a flowering condition whenever necessary by extra dark treatment.

In the Chemistry Section, thousands of analyses are made every year to assess the juice quality of seedlings at various stages of selection. Surveys of juice quality and milling behaviour of varieties in cultivation in the various factory zones are also conducted. Besides this, the chemical composition of the sugarcane juice, as it affects the quality of *gur* and white sugar, is being studied with particular reference to such constituents as total nitrogen, protein nitrogen, ash and colloids.

In the Mycology Section, resistance ratings to red rot of all newly evolved varieties are determined by artificial inoculations in final test plots. Similar tests are being conducted for resistance to the smut disease. Investigations are also in progress on mosaic, root rot and other cane and seedling diseases.

Observations on the field incidence of pests as well as control of termites and borers by recent insecticides and study of their phyto-toxic effects are being carried out in the Entomology Section. Both the Mycology and Entomology Sections keep a close watch on the varietal plots and also check the phyto-sanitary condition of cane material imported or exported by the Institute to other States and foreign countries.

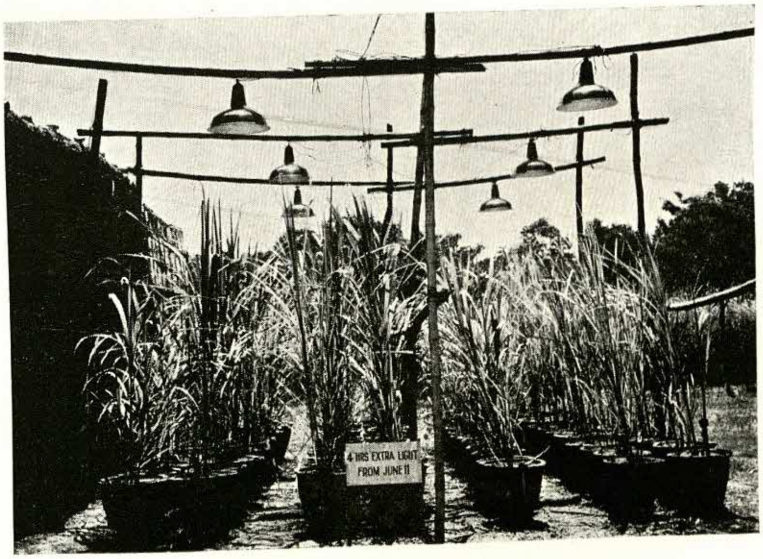
At the Sugarcane Substation, Karnal, a live herbarium of Coimbatore cane varieties is being maintained, and morphological descriptions are recorded. Co-ordinated seedling selection work including frost resistance has also been started.

POST-GRADUATE TRAINING

The Institute offers two post-graduate courses for specialised training (i) in plant breeding and Genetics with special reference to sugarcane and (ii) in agronomy of sugarcane ; both the courses being of two years' duration. These are being conducted in collaboration with the Indian Agricultural Research Institute, New Delhi. A one-year short course in breeding of sugarcane is also offered.

The Institute has also made provision for a short course of three or four months' duration for those actually engaged in sugarcane work in Government Departments, factory estates or private farms. Suitable candidates are also permitted to undertake research work in an honorary capacity, under supervision and guidance of the technical staff of the Institute, leading to M.Sc. and Ph.D. in Botany of the Madras University.

Hybrid sugarcane seedlings in the nursery plot, Sugarcane Breeding Institute, Coimbatore



Photoperiodic treatment of cane varieties for controlling flowering, Sugarcane Breeding Institute, Coimbatore

The Institute maintains close contacts with the cane growers and the industry. A large number of enquiries are received every year from cane growers and factories regarding sugarcane varieties and sugarcane culture. Members of the staff visit the State Sugarcane Research Stations, surgarcane fields and factories. These visits and discussions have encouraged the agriculturists to bring their problems to the Institute for advice.

INDIAN INSTITUTE OF SUGARCANE RESEARCH

Lucknow (U.P.)

THE need for establishing a Sugarcane Research Institute of an all-India character was voiced as early as in 1920 by the first Indian Sugar Committee set up by the Government of India, and this proposal was also reiterated in the year 1933. But owing to certain unavoidable circumstances, it could not be given any serious consideration. In the meanwhile, with the grant of tariff protection to the Indian Sugar Industry in 1932, research work on all important aspects of the sugarcane crop received considerable impetus; firstly, under the various sugarcane schemes of the Indian Council of Agricultural Research and later, from 1946 onwards, under the auspices of the Indian Central Sugarcane Committee. The sugar industry in India also underwent a phenomenal growth. The research activities, however, remained confined to the regional sugarcane stations, viz Jullundur in the Punjab, Shahjahanpur in Uttar Pradesh, Pusa in Bihar, Anakapalle in Madras and Padegaon in the Bombay-Deccan. These centres, being regional in character, naturally remained engrossed in their respective zonal problems with the result that fundamental research was largely neglected. It had, therefore, been all along considered necessary that there should be an all-India institute for undertaking fundamental and integrated research, besides co-ordinating the activities of the regional research stations. Consequently, the Indian Institute of Sugarcane Research was set up at Lucknow in 1952.

The Government of India took over the Institute from the Indian Central Sugarcane Committee from the 1st January, 1954. The Section of *Gur* and *Khandsari* Research was transferred to the Institute from the control of the Indian Institute of Sugar Technology in July, 1955.

The Institute began with Sections of Agronomy, Entomology. Mycology and Agricultural Engineering. Two more Sections, viz Soil Chemistry and Microbiology and Physiology have recently been added.

The Institute is provided with a farm of 556 acres in area for experimental purposes, and has an 'A' class meteorological observatory. The various laboratories are being equipped. The engineering workshop, glass-houses for agronomical and physiological studies, and a field insectary for parasitological work are yet to be erected.

FINANCE

The entire expenditure of nine lakhs for the Institute and the *Gur* and *Khandsari* Research Scheme is provided from the Central revenues.

RESEARCH ACTIVITIES

It is one of the main functions of this Institute to undertake integrated studies, so that both the sugarcane growers and the sugar industry might be able to derive greater benefits. The Institute also aims at co-ordinating the work in different subjects conducted at the regional stations, to enable recommendations to be made on an all-India basis, and bring closer together the research and the field workers.

The general scope of investigations carried out at this Institute is summarised below.

Agronomy

A plan of studies has been drawn up with due consideration to the present-day problems of growing sugarcane. At present, the improved varieties occupy nearly 90 per cent of the area under cane. Although these varieties have given as much as 70 to nearly 100 tons of cane per acre at Government and some private farms, the average yield of sugarcane per acre during the last two decades has remained more or less stationary. Thus the full potentialities of the improved varieties of cane are still to be realised in practice.

The germination of buds is lower in the North Indian sugarcane belt, the average varying between 30 to 35 per cent. Since early emerging mother plants and tillers form better millable cane, the question of germination merits intensive study. There is a good deal of emphasis at present on the heavy manuring of cane to obtain high yields, but this is generally without little or no reference to the nature of the soil or climate. The extent to which the juice quality is influenced by heavy manuring remains to be fully ascertained. Quantitative investigations are also required to determine how far the macro-and micro-nutrients, applied as a foliar spray, would influence the juice quality of the canes.

It is also proposed to undertake a study of the agrobiological laws, since they would help in proper understanding of the phenomenon of crop growth under a particular set of environmental conditions. There is thus a great need for detailed work, with a view to establish, if possible, some relationship between the plant growth and the growth factors.

The question of spacing in between the cane rows to permit smooth and easy mechanisation of cultural operations under conditions obtaining in different regions, will be also taken up.

Soil and microbiology

The effect of the nature of soils on yield and quality of sugarcane has been long established; but little has so far been done for furthering researches on the nature of the cane growing soils in India. Characteristics of the sugarcane soils have been determined in the Deccan Canal tracts of Bombay, Uttar Pradesh, Bihar and some parts of the Punjab. Thus, prior to any further large-scale work being undertaken, it is essential to take stock of the researches so far conducted in the various regional research stations. The compilation of available data will help a good deal in evolving some satisfactory method of soil classification of the sugarcane tracts in India, chiefly for the purpose of conserving the soil and its fertility in respect of the sugarcane crop.

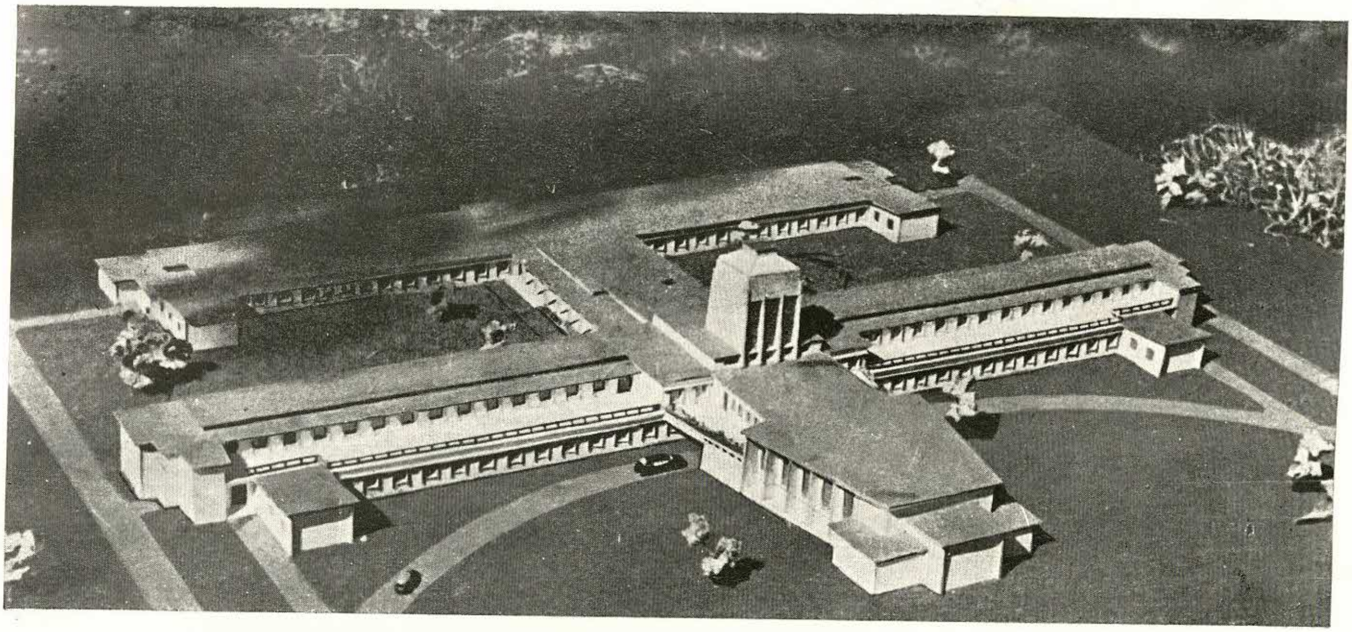
It is also intended to initiate a comprehensive study of the effects of the different crop rotations followed in the various sugarcane regions of India on the overall fertility of the soil. These studies will subsequently be supplemented by work on soil ameliorants and conditioners, with special reference to the sugarcane soils. Micro-biological studies will centre round the investigations on the influence of application of fertilizers and manures as well as rotational practices on the fertility of the soil.

Very little work has so far been done on the soil pathogens in India. The study of soil pathogens will form the basis for determining the inhibiting factors in respect of germination and growth of sugarcane. Besides, work will also be undertaken on the physiology of nodule bacteria and on the effect of manure catalysers on the population of symbiotic organisms.

Pests of sugarcane

For stimulating research on sugarcane pests, the Indian Central Sugarcane Committee started in 1946 an Insect Pests Scheme in the major sugarcane producing States in India. The research items on the technical programme of this scheme include borer population studies in relation to weather, cli-

[PLATE LXIV



Building for proposed National Sugar Institute, Kanpur

Planting sugarcane setts, National Sugarcane Institute, Lucknow

A crop of sugarcane, Co. 453 National Institute of Sugarcane Research, Lucknow

mate and micro-climate, assessment of damage done by the different species of borers, study of the alternative host plants and the natural enemies (parasites and predators) and investigations on the biology and control of borers, *Pyrilla*, termites and white-flies, etc. by cultural, mechanical and chemical methods. The scheme has since been in operation at Jullundur (Punjab), Shahjahanpur (Uttar Pradesh), Pusa (Bihar), Burdwan (West Bengal), Coimbatore (Madras), Rudrur (Hyderabad), and Walchandnagar (Bombay). Till 1951, the research work remained unco-ordinated and only the regional centres conducting these studies could derive some benefits out of these efforts. The responsibility of co-ordinating and guiding entomological research under the Insect Pests Scheme was, therefore, assigned to the Entomologist of this Institute in the year 1952. The collection and critical examination of the research data available for the period 1946-51, at the various scheme centres in India, led to the publication of a resume, incorporating information of practical utility to the growers and containing suggestions for future research in sugarcane entomology. Besides this, the publication of a review of all the papers on sugarcane entomology, published by Indian workers during the period 1934-54 has also proved very valuable.

The entomological staff of the Institute has done some pioneering work by undertaking successful aerial spraying against *Pyrilla* in the former Bhopal State. The observations on the migration of the stalk borer, *Chilotraea auricilia* Ddgn. in the terai areas of Nainital district of Uttar Pradesh and discovery of an alternate host plant for this borer in *baru* (*Sorghum halepense*) at the Institute farm for the first time in the country were other notable contributions of this Institute.

Among the problems under study at present, the most important one relates to biological control of the sugarcane pests, particularly the borers. The parasite, *Trichogramma evanescens minutum* Riley, was tried against the shoot borer, *Chilotraea infuscatellus* Snell, during 1946-50. But in view of its ineffectiveness, the experiments were discontinued in April, 1950. Since then, no efforts have been made to try any other indigenous parasite against the sugarcane borers. However, during 1953, an opportunity, afforded by the Technical Co-operation Mission working in Indonesia, was availed of in preparing ground work for the exchange of effective moth borer parasites between the two countries. A scheme has now been prepared for (i) inter-changing effective indigenous parasites for trial purposes within the important cane growing tracts in India, and (ii) setting up parasite exchange programmes with other countries where climatic conditions approximate those prevailing in India.

Another item on the programme is the study of the various methods of assessing the incidence of pests and their population, in vogue at present in the different States in India, so that they could be standardised and the information collected in the different cane tracts may be comparable. This would help not only in providing quantitative data needed for determining the nature and the precise mode of the control operations but also for an appraisement of the consequential damage to the crop, if any.

The preparation of insecticide schedules for the control of pests is also contemplated. A number of operations by way of spraying or dusting are generally suggested to control the various pests that damage the sugarcane crop during the different stages of its growth. Such a programme of chemical control becomes very tedious and costly and cannot be expected to be popular with the growers. Efforts are, therefore, being made to prepare a schedule of chemical control operations which may give relief from a number of pests by a very limited number of applications. Another aspect of chemical control under study is the feasibility of combining different insecticides with fungicides or weedicides with a view to achieving simultaneous control of pest and disease or weed.

A survey of the cane pests and of the fauna visiting sugarcane during different stages of its growth is being undertaken to prepare maps depicting the occurrence and incidence of the various pests in different cane tracts of the country.

Sugarcane diseases

The important diseases of cane in the country at present are red rot, smut, mosaic, red stripe disease, top rot, grassy shoots, twisted top, browning of leaves and striga.

Red rot. This is the most serious disease of cane in the Punjab, Bihar, Uttar Pradesh, West Bengal, and Madhya Bharat, which together cover about 80 per cent of the total cane acreage in the country. The recurrence of the epidemics with the development of newer and more virulent strains has upset the varietal position more than once. Various strains of the disease have, therefore, to be studied in all the affected areas to determine their relative virulence under uniform conditions. A comparison of the texture of the colony, serial mycelium, slimy masses of conidia and virulence, made at this Institute, reveals that the light races of Bihar and 'D.139' of West Bengal are identical. A study of the other strains is in progress, while the role of the collateral hosts in the spread of the disease is being ascertained. The morphological, anatomical or physiological characters of the cane varieties in relation to their resistance to red rot are being investigated.

Smut. This disease was not considered serious till 1942-43 when it assumed serious proportions in nearly 66 per cent of the total area under cane in Bihar. Recently, the survey of cane diseases in Madras, undertaken by the Mycologist of this Institute, has revealed heavy infection of smut in Co. 419, particularly in the Central and Eastern Zones of the State. Collection from the affected varieties shows variation in colour of spores and echinulations. A taxonomic study of spores has been, therefore, started.

Mosaic. Experiments carried out in several States show that this disease causes a loss of 19 per cent in yield in the thick cane (*Sukha Saharanpuri*) and 10 per cent in Co. 313 and Co. 210, besides considerable losses in sucrose content and the purity of juice.

A survey of cane diseases in Madras State by the Institute Mycologist showed that the varieties Co. 527 and Co. 449 were severely affected with mosaic (60 to 100 per cent incidence on clump) in all the areas excepting the West Coast. Mosaic is reported to be on the increase in Madras State and hence, immediate investigations have to be undertaken to ascertain (i) whether any new or more virulent strains have developed since 1939 when the work on mosaic was discontinued, (ii) the extent of masking of symptoms in various varieties, (iii) the extent of recovery from mosaic, (iv) the extent of secondary infection, (v) the possible insect vectors with a view to checking the spread of the disease, and (vi) the assessment of the losses in yield and quality.

Red stripe disease. The survey of cane diseases undertaken in May, 1955, in Bombay revealed reddening of leaf-sheaths and rind, softening and thinning of upper inter-nodes and drying up of a few shoots in Co. 419 at the Sugarcane Research Station, Padegaon, and in Phaltan Sugar Estate. Some of the fundamental aspects of the disease have to be investigated in order to evolve suitable control measures.

Top rot. This has also been considered to be a minor disease so far. But recently Co. 658 has been found to be severely affected with top rot in the Factory Farm, Nellikuppam, each successive attack causing considerable shortening of internodes. The incidence of the disease is so high that there is no prospect of the release of this variety which is otherwise very desirable. The withdrawal of Co. 658 is another instance of a variety going out of cultivation on account of the so-called 'minor' diseases. The unexplored aspects of this disease are being studied at this Institute.

Grassy shoots, bunchy disease or leafy tuft. The appearance of a large number of short narrow leaves, about a foot in height, instead of the normal shoots, lends the appearance of grass to the cane. Here the loss is complete, since no cane is produced. The nature of the disease is now under investigation at this Institute.

Twisted top. The young spindle gets twisted spirally or tangles and dies early. Side shoots sprout as the top ceases to grow and the plant presents an appearance of apparent recovery, followed sometimes by a second attack. In cases of severe attack, the canes are much thinner than the normal.

Browning disease of leaf. The affected shoots show browning of leaves. Small dots, yellow in colour, appear in the beginning but turn brown and spread later on. Ultimately the entire leaf becomes brown in due course. No organism has been so far found to be associated with the disease.

Striga. This root-parasite has been found to cause serious losses in tonnage and quality of cane in Bihar, Madhya Pradesh and Madras. Applications of Agroxone liquid at 1 per cent and Fernoxone at the rate of 1 lb. per 100 gallons of water have been found effective in smothering the parasite in Bihar and Madras, although for complete elimination of the parasite, another application of the chemicals at half the original dosage is sometimes needed a month after the first treatment. Basic studies on the efficacy of other chemicals have been taken up.

Physiology of sugarcane

Very little work has so far been done in India on some of the important physiological aspects of the sugarcane crop. A mention may particularly be made of the lack of information on (a) physiological factors responsible for varietal deterioration, (b) the nature of antibiotic substances in respect to sugarcane and crops grown in rotation with it, (c) the possibility of adopting foliar nutrition techniques with a view to subsidising manuring through the soil and (d) the role of plant hormones in the development of sucrose and inducement of flowering in cane. These investigations will be undertaken so as to be able to secure a better appreciation of the causal factors leading to contradictory and anomalous growth habits of the important commercial varieties of cane, as observed in the different regions of the country.

Khandsari and jaggery

Realising the importance of the indigenous systems of *gur* and *khandsari* sugar manufacture, investigations were started in the year 1937 for introducing improvements in the existing open pan machinery. Since then 36 different types of bullock-driven and five power-driven crushers as well as 28 single pan and nine multiple-pan furnaces have been tested for determining their capacity, milling efficiency and fuel consumption. The data regarding the rate of evaporation and boiling efficiency of the furnaces under normal conditions have also been collated. They furnish for the first time a knowledge of the comparative efficiency and capacity of the different furnaces, and reveal that the majority of the furnaces have not been designed scientifically and thus need further improvement. Eight vegetable and six chemical clarificants have been tested for relative efficiency and effects on the finished products. Research work has been also conducted on six types of containers to ascertain their suitability for storing *rab* (molasses). Investigation of an exploratory nature has also been conducted on the working of the various indigenous processes of manufacturing *gur* and *khandsari* sugar in vogue in the different cane tracts in the country, with a view to ascertaining the scope of improvement. In multiple pan furnaces, grate and air preheating arrangements have been introduced, which has considerably improved the boiling efficiency of the furnaces. Most of the furnaces have become self-sufficient in the matter of fuel, It has been possible to increase the available sugar by 8 to 10 per cent by making improvements in the processes. A simplified process of carbon treatment for the decolourisation of juice has been evolved, making it possible to handle even large quantities of juice with comparative ease. Similarly, by adding juice to molasses in the proportion 2 :1, *gur* of improved type has been produced. Further, to check the loss of sugar by inversion during boiling in the course of manufacture of sugar from *gur*, the process of melting *gur* in lime water to produce *rab* subsequently and clarifying it by diluted skimmed milk has been found effective.

Cane crushers like *Bilari kolhu* (crusher) and I.C.A.R. crusher Nos. 1, 2 and 3 have been designed; and new furnaces, e.g. *Bilari bel* Nos. 1 and 2, three pan molasses *bel* and molasses *bel* worked with wood fuel have also been successfully worked.

It is further intended to undertake an investigation for evolving blowers for the sulphitation process as applied to the *khandsari* industry and a simple type of sugar drier for *khandsari* sugar, as the present system of sun-drying is not found suitable, particularly under conditions of high humidity. Attempts will be made to evolve better methods for the large-scale storage of *gur* during the rainy season. The possibility of introducing the open pan system, the new process of juice clarification evolved by Saha and Jain for vacuum pan factories will also be explored.

Agricultural Engineering

A critical survey of the agricultural implements being used in sugarcane cultivation in the States of Madras, Mysore, Andhra, Uttar Pradesh and Bihar has been conducted. It has revealed that little concentrated effort has been made to evolve specialised agricultural implements for cane-cultivation, although a few improved implements at the State Research Stations are being successfully used in restricted areas. In view of this, efforts are now being directed towards evolving new implements, testing them under different conditions prevailing in the cane tracts, effecting necessary modifications to economise cost of manufacture and operations without appreciably reducing the life or adversely affecting their performance. Work is also in progress to determine the extent to which cane cultivation can be economically mechanised in the country. A tractor driven sugarcane cultivator has been invented by the Institute.

NATIONAL SUGAR INSTITUTE

Kanpur (U.P.)

THE Indian Sugar Committee of 1920 recommended the establishment of a central research institute for the proper development of the sugar industry in this country. The need for such an institute was also emphasised in the Tariff Board Report of 1930. The Government of India accordingly started the Imperial Institute of Sugar Technology in October, 1936, and housed it in the building of the Harcourt Butler Technological Institute, Kanpur. Since its inception, the Institute worked under the administrative control of the Imperial Council of Agricultural Research. The Institute was transferred to the administrative control of the Indian Central Sugarcane Committee from 1st of March, 1945. Consequent on India attaining independence, the name of the Institute was changed to Indian Institute of Sugar Technology. The Institute was financed out of grants made to the Indian Central Sugarcane Committee from the Sugar Excise Duty. Subsequently the administrative control of the Institute was transferred to the Ministry of Food and Agriculture, Government of India, with effect from 1st January, 1954 and is now being financed out of general revenue. The Institute has now been renamed as National Sugar Institute.

FUNCTIONS

The main functions of the Institute are the following:

(i) to undertake research on (a) problems pertaining to sugar technology, sugar and sugarcane chemistry, and sugar engineering in general and those of sugar factories in particular and (b) utilisation of the bye-products of sugar industry,

(ii) to give technical advice and assistance to sugar factories with a view to improving their efficiency and assist other sections of the industry and the Central and State Governments in matters relating to the sugar and allied industries,

(iii) to collect, collate and issue technical statistics relating to sugar industry,

(iv) to provide technical education in all branches of sugar chemistry and technology and provide training in research,

(v) to prepare and issue the Indian Sugar Standards, and

(vi) to survey factory plants and processes to economise fuel consumption and increase overall efficiency.

Research

Research is the main activity of the Institute and is being carried out by the staff and the students working for the Fellowship and Ph.D. degree. Problems relating to sugar technology and on the utilisation of bye-products of the sugar industry are taken up for investigation. The results of research are regularly published.

The more promising results are passed through different stages of development whenever finance and facilities are made available. Some of the more important problems that are being tackled at present are:

1. Deterioration of sugars during storage
2. Studies on the middle juice carbonation process
3. Exhaustibility of molasses

4. Milling investigations
5. Clinker formation in boiler furnaces and its removal
6. Effect of spraying molasses and phyto-hormones on the quality of sugarcane
7. Pre-harvest survey of sugarcane crop for maturity control in sugar factory zones
8. Working out a rapid method for estimation of reducing sugar severally in molasses and other sugar house products
9. Pilot plant studies of the Ion-Exchange method of cane juice clarification in collaboration with the N.R.D.C.
10. Study of the quality characteristics of cane wax
11. Studies on Poly Saccharides
12. Corrosion of metals by cane juice
13. Deterioration of colour of sugar due to storage
14. Utilisation of carbonation press mud
15. Utilisation of bagasse for burning lime-stone
16. Use of versene in sugar industry
17. Studies on the blackening and feathering of containers of fruit preservers (in co-ordination with the Bio-Chemistry Section)
18. Scale formation and its removal in evaporators
19. Foaming of syrup
20. Burning of limestone chips
21. Treatment of sugar factory and distillery effluents
22. Fodder-yeast from molasses.

Teaching

The various courses of instruction are comprehensive so that the students after completion of their respective courses can straight away assume positions of responsibility in the industry. This is amply borne out by the fact that today almost every sugar factory in the country has in its employ former students of the Institute and that these technologists, therefore, must have had to their credit substantial contribution to the technical advancement of the industry. The particulars of the courses are given in the following statement.

Courses of Instruction in the National Sugar Institute

Course of instruction	Nature of training	Qualifications for admission
Research courses :		
1. Ph.D. degrees of the Universities of Agra, Madras, Punjab, Saugor, Travancore, Nagpur, Calcutta and Poona	Research is conducted in physical, organic, agricultural and bio-chemistry. Generally 3 years' work is required	First or second class M.Sc. degree in chemistry of the respective university
2. Fellowship of the Institute (F.N.S.I.) Diploma	Research is carried out in sugar engineering, sugar chemistry and sugar technology. Generally twelve months' work is required at a stretch or divided in 3 off-seasons of 4 months each, preceded or followed by two seasons' practical training in a central sugar factory	A graduate degree or equivalent in Engineering; Associateship Diploma (A.N.S.I.) or first or second class M.Sc. degree in chemistry or equivalent of an overseas institution
Non-research courses :		
3. Associateship of the Indian Institute of Sugar Technology (A.N.S.I.) Diploma	Theoretical and practical instructions including one season's practical training in the experimental factory and one season's practical training in an outside commercial factory. (i) Sugarcane cultivation, (ii) sugar manufacture and chemical control, sugar chemistry, organic chemistry, bio-chemistry and utilisation of by-products, (iii) sugar engineering, (iv) chemical engineering, (v) statistics and engineering economics, factory organisation and administration. Training is imparted in two full academic years	A graduate degree in physics, mathematics, chemistry or agriculture or equivalent qualification
4. Non-research short courses		
(i) Sugar Engineering Certificate Course (for Factory Staff)	Theoretical and practical instruction in laboratories, workshops, drawing design classes and experimental sugar factory. Two off-seasons' training at the Institute	Diploma in engineering of a recognised technical school or college and at least one year's practical experience of a commercial sugar factory
(ii) Sugar boiling Certificate Course (for factory staff)	Lectures and laboratory work in elementary sugar technology and advanced pan boiling. Practical pan boiling in the experimental factory. One term's work is required.	Matriculation with science or equivalent qualification and at least one season's practical sugar boiling experience in a commercial sugar factory before admission and one further season's training at the Institute.

For purposes of imparting instructions, apart from well-equipped laboratories and workshop, there is an Experimental Sugar Factory with a capacity of 35 tons cane per day provided with an electrically driven milling plant and a boiling house for working on sulphitation process, and a library containing 5,800 volumes of technical and technological books and 200 journals. Provision is also available for taking out students on tours to sugar factories, local workshops and engineering works to help and acquaint themselves with the usual conditions of working and fundamentals of processes.

Technical advice and assistance

Technical officers and staff of the Institute are being deputed to sugar factories on payment of prescribed fees whenever called by factories to investigate problems on the spot.

Advice is given to promoters of new factories and for extensions and alterations to existing plants and for improving efficiency.

Assistance in regard to technical matters is being provided to the Central and State Governments.

Consolidated statements of technical data from all factories are being compiled and issued periodically for the benefit of all factories.

Reviews of the working of sugar factories and of the quality of sugar produced in India are being prepared and issued annually.

Analyses of samples of sugars and various chemicals and materials used in the sugar industry are carried out.

The instruments and apparatus used in the sugar industry are repaired, overhauled and calibrated.

BUREAU OF SUGAR STANDARDS

The Bureau of Sugar Standards prepares and supplies sugar standard sets every year, publishes an annual review of the quality of different grades of Indian sugars and gives comparative figures for different years and carries on research regarding grading of sugar standards. An Advisory Committee representing sugar manufacturers, sugar merchants and brokers and technologists advises on the modification of the standards to bring them in conformity with the requirements of various interests. Each of the Indian Sugar Standards sets consists of a set of samples of sugar arranged in order of quality judged in terms of grain size and colour. The samples are specially prepared by selection from a large number of samples obtained from all factories, and after sieving through standard sieves and drying, are filled in colourless glass bottles, sealed, numbered and arranged in well-finished teak wood boxes. The standards are so selected as to form a continuous scale. The matching of samples with the standards is done in diffused daylight taking the usual precautions. The yearly supply of standard sets (new and refilled) comes to about 250 sets.

FUEL ECONOMY SCHEME

A scheme for effecting fuel economy in sugar factories is attached to the Institute and has been working for the last seven years. So far 45 factories have been completely surveyed and 27 are now being attended to. The scheme has been responsible for eliminating excess fuel consumption in most of the factories so far surveyed and making them save bagasse instead. In the case of other factories completely surveyed, the working of the factories has further improved.

A scheme for solving the problems confronting the industry on the question of payment of cane price on the basis of its quality is being worked out in nine sugar factories on a trial basis under the guidance and control of the Institute with effect from January 1957. This scheme aims at improving the quality of sugarcane and thereby increasing the outturn of sugar by sugar factories.

FUTURE DEVELOPMENT

Soon after taking over the Institutes, the Ministry of Food and Agriculture appointed a Committee to examine the existing equipment and facilities for research at the Institute and to recommend measures for improving the efficiency of the Institute. This Committee made a number of important recommendations which are being implemented as indicated below:

1. A Chemical Engineering Section is being organised
2. An Instruments Section is being added
3. The Engineering Laboratory is being further equipped
4. A Photo Printing Section has been brought into existence
5. The Experimental Sugar Factory is being modernised
6. Some modern special apparatus are being procured for further equipping the research laboratories
7. A pilot plant shed is proposed to be built up
8. The library is being expanded
9. Fellowships have been instituted for research in sugar and allied technology.

Under the Second Five-Year Plan, a Scheme of Extension Service has been sanctioned for bringing the technical efficiency of the commercial sugar factories up to the mark.

About 500 acres of land are being acquired in Kalyanpur (Kanpur) where the new building of the Institute is to be built. It has also been decided to instal a new completely up-to-date and fully equipped experimental sugar factory of 400-600 tons per day capacity at the new site.

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL SUGARCANE COMMITTEE

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned* (Rs. in lakhs)	Objectives	Achievements	Remarks
Crop weather studies, Poona	Centre	15 Years (1946-61)	1.56	To study and collate data pertaining to climatic conditions on the growth, germination, tillering and pests and diseases of sugarcane		Scheme current
Research on diseases, I.A.R.I.	Centre	16 years (1945-61)	1.63	Study of inheritence of disease resistance and testing sugarcane varieties against red-rot and smut		do.
Research on Red-rot fungus flora	Centre	2 years (1957-59)	*-nil-*	Study of factors responsible for change of red-rot fungus flora	Scheme not yet started	
Research Station, Shahjahanpur	Uttar Pradesh	16 years (1945-61)	16.81			
Expansion of sugarcane research	Uttar Pradesh	5 years (1956-61)		Working out effective schedules of cultivation, cultural, manurial and irrigational data ; finding out suitable varieties of cane both in regard to high tonnage and sucrose content ; investigations on sugarcane insect pests and diseases and their control; evaluation of juice quality in standing cane and studies on soil characteristics		Schemes current
Sugarcane Research Scheme	Punjab	14 years (1947-61)	6.49			do.
Sugarcane Research Scheme	Madras	16 years (1945-61)	2.82			
Sugarcane Research Substation, Tiruchirapalli	Madras	5 years (1956-61)				
Central Sugarcane Research Station, Pusa	Bihar	16 years (1945-61)	11.05			
Sugarcane Substation, Patna	Bihar	14 years (1947-61)	2.30			
Sugarcane Research Scheme, Rudroor	Andhra Pradesh	16 years (1945-61)		Research on manufacture and storage of *gur*		do.
Sugarcane Research Scheme, Anakapalle	Andhra Pradesh	7 years (1954-61)	1.13			

*These figures represent grants sanctioned up to 1956-57. Additional grants will be sanctioned year after year.

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL SUGARCANE COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned* (Rs. in lakhs)	Objectives	Achievements	Remarks
Sugarcane Research Scheme	Orissa	13 years (1948-61)		Carrying out varietal, manurial, cultural and irrigational investigations in order to find out effective schedules in cultivation		Scheme current
Sugarcane Research Substation, Barapalle	Orissa	6 years (1955-61)	0.14			
Sugarcane Research Scheme	Assam	14 years (1947-61)	0.15	do.		
Sugarcane Research Scheme	W. Bengal	5½ years (1955-61)	0.04	Also to find out suitable varieties of cane both in regard to high tonnage and sucrose content		do.
Sugarcane Research Scheme	Bombay	15 years (1945-60)	3.33			
Soil extension work in Bombay	Bombay	5 years (1956-61)	0.10			do.
Control of wilt	Bihar	10 years (1947-57)	0.88	To investigate and control "wilt" disease of sugarcane		do.
Research on the incidence of *Pyrilla*	Bihar	1 year (1954-55)	0.09	Undertaking pot culture experiments to determine the effects of sap concentration on the incidence of *Pyrilla*		
Breeding thick canes	Mysore	9 years (1945-54)	0.41	Breeding of thick varieties of cane		
Establishment of regional research Substations, Kolhapur, Karnaek and Gujrat	Bombay	5 years (1956-61)	*-nil-*	To carry out agronomic experiments suited to local environments and needs		do.
Investigations into diseases of sugarcane	Bombay	5 years (1956-61)	*-nil-*	Investigation of new diseases of sugarcane		
Sugarcane Research Scheme, Sehore	Madhya Pradesh	5 years (1956-61)	*-nil-*	To carry out agronomical and plant pathological investigations		
Sugarcane Research Scheme, Dabra	Madhya Pradesh	5 years (1956-61)	*-nil-*	To carry out agronomical, entomological and chemical investigations		do.
Sugarcane Research Scheme	Rajasthan	5 years (1957-62)	*-nil-*	To carry out agronomical investigations	Scheme not yet started	

*These figures represent grants sanctioned up to 1956-57. Additional grants will be sanctioned year after year.

RESEARCH SCHEMES FINANCED BY THE INDIAN CENTRAL SUGARCANE COMMITTEE—(*Contd.*)

Name of the scheme	State, University, etc.	Period	Amount of grant sanctioned* (Rs. in lakhs)	Objectives	Achievements	Remarks
Insect Pests Scheme	Uttar Pradesh	15 years (1946-61)	0.62	To investigate the incidence of sugarcane pests and to find out their control measures		Schemes current
Insect Pests Scheme	Madras		0.83			
Insect Pests Scheme	Bombay		0.82			
Insect Pests Scheme	Bihar		0.75			
Insect Pests Scheme	Punjab		0.68			
Insect Pests Scheme	W. Bengal		0.33			
Insect Pests Scheme	Andhra Pradesh		0.29			
Insect Pests Scheme	Andhra Pradesh		0.02			
Insect Pests Scheme	Orissa	6 years (1945-51)	0.31			
Studies of criteria for the formulation of *gur* grades	Centre	2 years (1957-59)	*-nil-*	To study the physical and chemical criteria leading to the formulation of *gur* grades	Schemes not yet started	
Testing of cane crushers	Centre	5 years (1957-62)	*-nil-*	To carry out tests of suitable cane crushers	do.	
Study of *gur* manufacture and storage	Punjab	5 years (1957-62)	*-nil-*	To find out improved and economic methods of producing *gur* of a fine, more presentable and more marketable quality. Also to find out the best and most economic method of storage of *gur*	do.	do.
Study of *gur* manufacture and storage	Orissa	4 years (1957-61)	*-nil-*			
Study of *gur* manufacture and storage	Bihar	4 years (1957-61)	*-nil-*			do.
Study of *gur* manufacture and storage	Madras	4 years (1957-61)	*-nil-*			
Study of *gur* manufacture and storage	Madhya Pradesh	5 years (1957-62)	*-nil-*		do.	
tudy of *gur* manufacture and storage	Assam	5 years (1957-62)	*-nil-*		do.	

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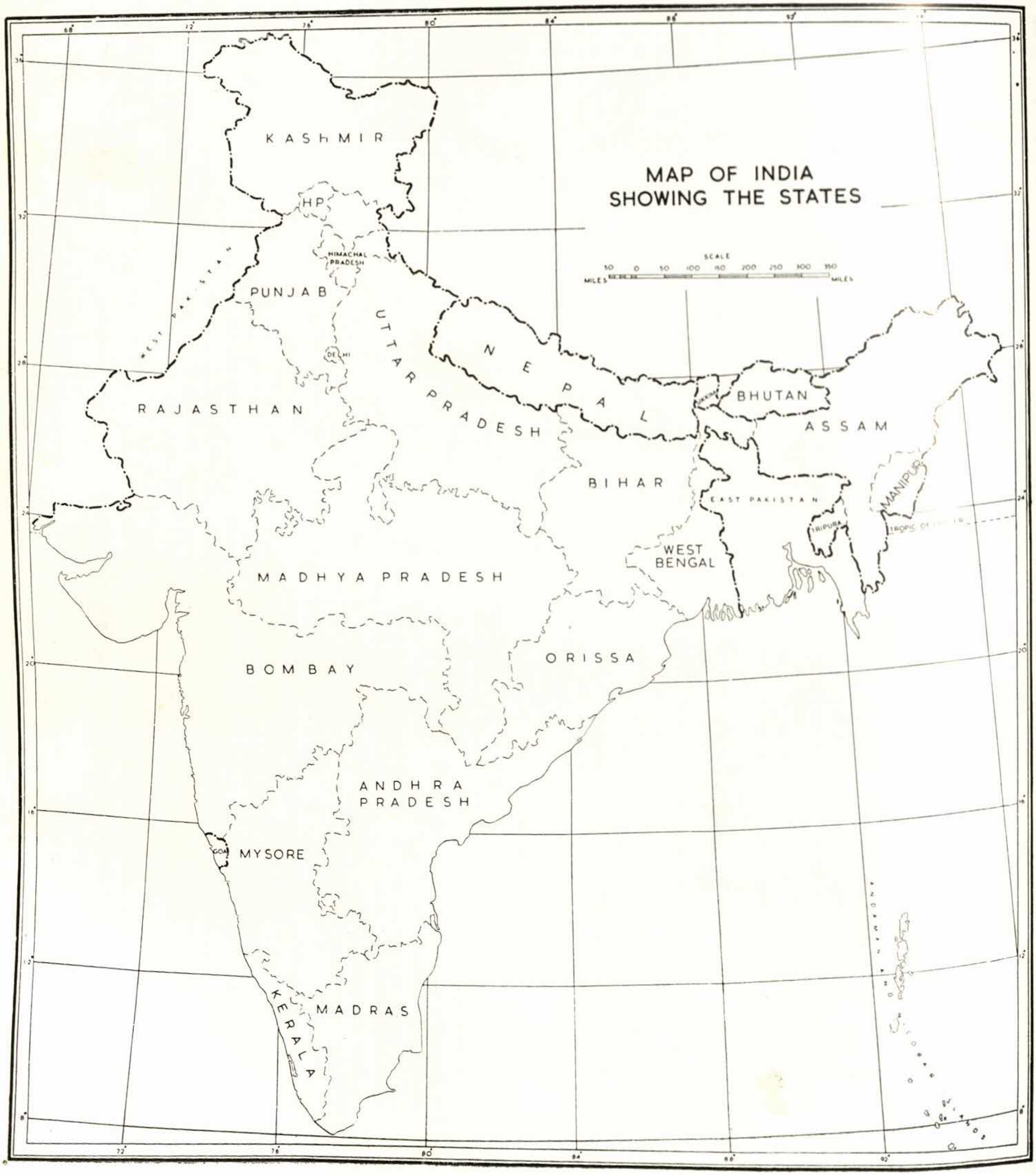
* These figures represent grants sanctioned upto 1957. Additional grants will be sanctioned year after year.

RESEARCH STATIONS
AND FARMS
IN THE STATES

PLATE LXV]



MAP OF INDIA
SHOWING THE STATES

RESEARCH STATIONS AND FARMS IN THE STATES

THERE are 564 research stations financed and run by the State Governments. Out of these 483 are agricultural research stations, and 81 animal husbandry research stations. Agricultural research stations are 86 per cent, and animal husbandry research stations 14 per cent of the total. The Statewise distribution of these research stations is given below.

Most of the agricultural research stations in the various States are of a general type carrying on research on a number of crops, but a few are meant to carry on research work on particular crops such as rice, wheat and horticultural crops. On the basis of crops handled, the State research stations are classified in the table below:

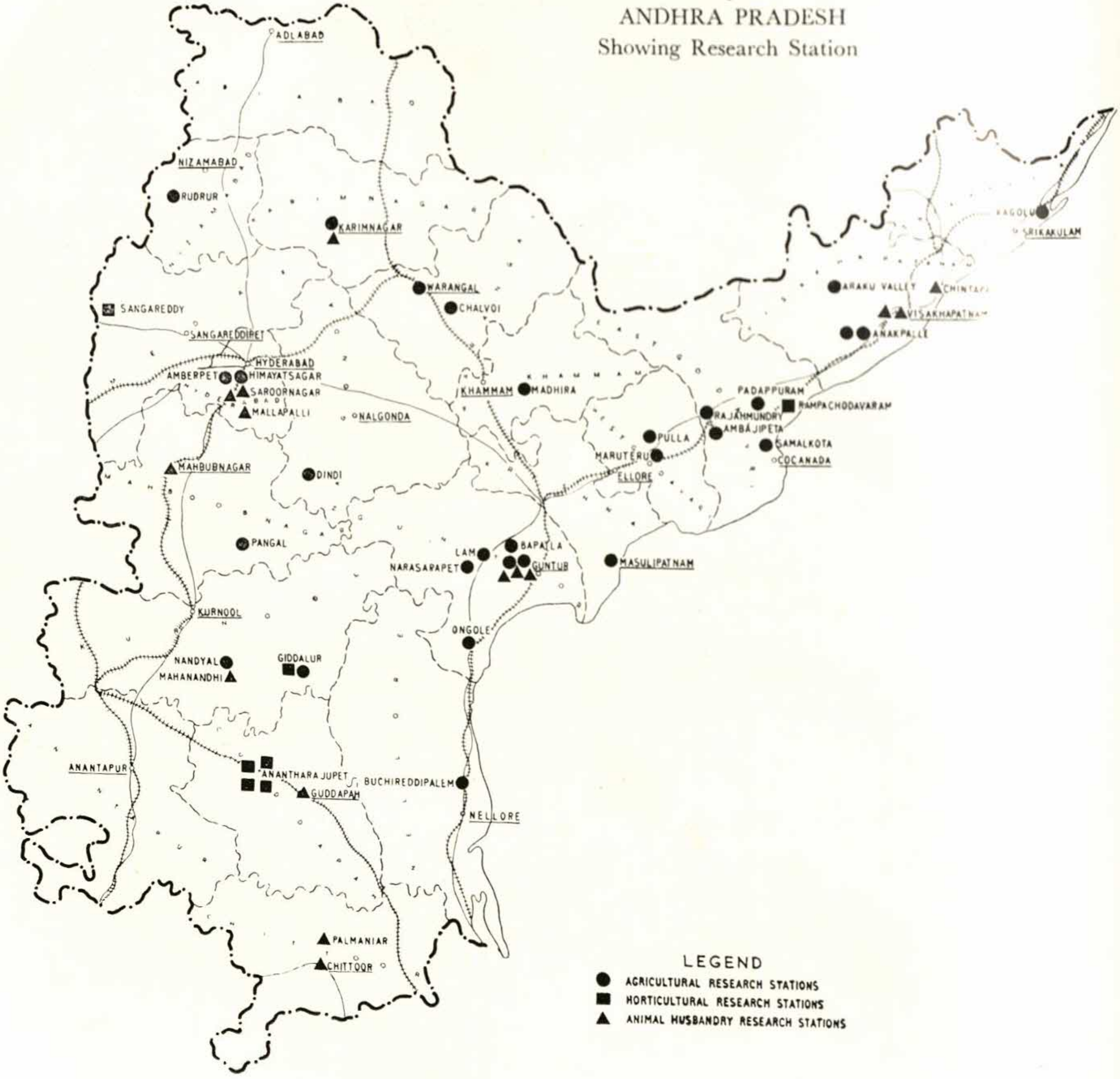
Distribution of research stations and farms in the States

Name of the State	Agricultural research stations	Animal husbandry research stations
1. Andhra Pradesh	33	19
2. Assam	15	3
3. Bihar	22	6
4. Bombay	66	9
5. Delhi	—	—
6. Himachal Pradesh	21	1
7. Jammu & Kashmir	18	2
8. Kerala	15	3
9. Madhya Pradesh	52	1
10. Madras	27	9
11. Manipur	7	—
12. Mysore	40	9
13. Orissa	46	10
14. Punjab	46	4
15. Rajasthan	10	2
16. Uttar Pradesh	41	2
17. West Bengal	24	1

Cropwise classification of research stations and farms in the States

	Andhra Pradesh	Assam	Bihar	Bombay	Himachal Pradesh	Jammu and Kashmir	Kerala	Madhya Pradesh	Madras	Manipur	Mysore	Orissa	Punjab	Rajasthan	Uttar Pradesh	West Bengal
1. General	15	6	20	41	15	13	5	44	14	6	36	41	38	9	34	20
2. Rice	16	7	3	20	3	7	8	21	9	3	16	2	5	—	9	7
3. Wheat	2	—	3	13	3	9	—	36	1	4	8	—	23	5	14	6
4. Millets	8	—	1	36	—	—	—	15	5	—	14	—	10	4	2	—
5. Maize	4	—	2	5	4	6	—	—	2	5	2	—	13	3	1	1
6. Potato	1	—	—	—	6	—	—	2	1	5	—	—	2	—	3	4
7. Tapioca	—	1	—	—	—	—	4	—	—	—	—	—	—	—	—	—
8. Cotton	4	2	—	26	—	—	1	8	8	1	12	2	16	1	4	4
9. Sugarcane	5	1	2	6	2	1	1	12	2	2	6	1	10	2	7	3
10. Jute	—	4	1	1	—	—	—	—	—	1	—	—	—	—	1	5
11. Tobacco	2	1	—	3	—	—	—	—	—	—	—	—	3	—	1	—
12. Coconut	2	1	—	—	—	—	4	—	1	—	1	2	—	—	—	—
13. Arecanut	—	1	—	—	—	—	2	—	—	—	—	—	—	—	—	—
14. Oilseeds	5	3	3	27	—	—	1	15	6	—	9	—	8	1	2	6
15. Mango	3	—	—	3	—	—	1	—	—	1	—	—	3	—	—	1
16. Citrus	2	—	1	4	—	—	1	—	1	5	1	1	3	—	—	1
17. Banana	—	1	—	3	—	—	3	—	3	1	1	—	1	—	—	2
18. Apple	—	—	—	—	1	—	—	—	1	1	—	—	2	—	1	—
19. Cashewnut	2	1	—	—	—	—	2	—	—	—	1	—	—	—	—	—
20. Cloves	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—
21. Cardamom	—	1	—	—	—	—	2	—	—	—	—	—	—	—	—	—

PLATE LXVI]



Map of
ANDHRA PRADESH
Showing Research Station

ANDHRA PRADESH

AGRICULTURAL RESEARCH STATIONS

1. Government Main Agricultural Experiment Station, Himayatsagar

Address and distance from Railway Station	Himayatsagar, District Hyderabad, 9 miles from Hyderabad Railway Station
When established	1927
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	29 inches Lat. 17.20° N Long. 78.22° E Alt. 1780 feet
Soil type	Sandy clay, clay loam and silt loam
Programme of research	Research on paddy, wheat, castor, *jowar*, maize, groundnut, safflower, linseed and vegetables

2. Rice Seed Farm, Amberpet

Address and distance from Railway Station	Sewage Farm, Amberpet, Andhra Pradesh, 3 miles from Kachiguda Railway Station
When established	Acquired from the Public Works Department, (Drainage Division) in 1951
Whether, research, multiplication or demonstration farm	Multiplication-*cum*-research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	22 inches Lat. 17° N Long. 78° E Alt. 1750 feet
Soil type	Sandy loam, sandy clay, clay loam and silt
Programme of research	Research on paddy and maize

3. Fruit Research Station, Sangareddy

Address and distance from Railway Station	Sangareddy, District Medak ; 12 miles from Shankarapalli Railway Station
When established	Experimental farm started in 1918, was converted into Fruit Research Station in 1955
State, University or private managed	State managed; Fruit Research Scheme is financed by the State as well as I.C.A.R
Whether research, multiplication or demonstration farm	Research and multiplication of improved seeds and fruit plants

Annual rainfall, latitude, longitude and altitude	Lat. 170° 37′ N.L Long. 78° 5′ E.L Mean Sea level 1702.3 feet
Soil type	Red sandy loams (Chalka) and black clayey loams
Programme of research	(*a*) *Mango*: (1) Collection of promising varieties from all over India and assessing their performance and suitability to the tract (2) Breeding with a view to evolve varieties of better quality and off-season bearers (3) Devising optimum cultural practices for obtaining regular yields (*b*) *Anonaceous fruits*: (1) Collection of promising species and varieties of *Sitaphal* and assessing their performance (2) Comparative study of clonal progeny of outstanding *sitaphal* trees (3) Rootstock trials to select the optimum rootstock for *sitaphal* and *cherimoyer* (4) Study of different methods of propagation, top working and rejuvenation of old trees (5) Hybridisation between different species and varieties of Sitaphal with a view to evolve seedless and desirable varieties (*c*) *Vegetables*: (*Chillies and Bhendi*) (1) Collection of promising varieties from all over India and assessing their performance (2) Varietal trials to select the superior ones for the tract (3) Propagation of pedigreed fruit plants and vegetable seeds for supply to the public (4) Demonstration and training in improved methods of horticulture to the public

4. Rice Research Station, Masulipatnam

Address and distance from Railway Station	Masulipatanm, Krishna District ; 2 miles from Masulipatnam Railway Station
When established	1954
Whether research, multiplication or demonstration farm	Research station
State, University or private managed	State managed
Annual rainfall	45 inches
Soil type	Saline soils
Programme of research	Research on all aspects of rice cultivation

5. Fruit Research Station and Government Fruit Nursery, Anantharajupet

Address and distance from Railway Station	Anantharajupet P.O. and Koduru R.S. (On the Madras-Bombay main line—Southern Railways). Cuddapah District 3½ miles from the Koduru Railway Station
When established	1935
Whether research, multiplication or demonstration farm	Research-*cum*-Nursery to raise fruit plants for supply
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	37 inches Alt. 642 feet above M.S.L.
Programme of research	Varietal trials in mango, citrus and other fruits, rootstock trials and allied investigations in citrus and mango. Agronomic field trials on several cultural aspects, evolution

of new and improved strains in mango, citrus, guava and other fruits through hybridisation, selfing, etc. Miscellaneous trials including propagational methods of several fruits and other perennial crops, storage trials in various fruits, pruning of guavas, biological studies on guavas, cashew, etc. shoot growth studies on mango, etc. Propagation of pedigree plants for supply to growers

6. Government Fruit Preservation Research Laboratory and Factory, Anantharajupet

Address and distance from Railway Station	Anantharajupet P.O. and Koduru R.S. (on the Madras-Bombay main line—Southern Railway) Cuddapah District, 3½ miles from the Koduru Railway Station
When established	1943 and 1954 respectively
Whether research, multiplication or demonstration farm	Research-*cum*-production centre
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	37 inches Alt. 642 feet
Programme of research	Research on all aspects of fruit and vegetable preservation and production of standard products on the basis of the results achieved

7. Fruit Research Station (New Rootstock Trial Station), Anantharajupet

Address and distance from Railway Station	Anantharajupet P.O. and Koduru Railway Station (on the Madras-Bombay main line—Southern Railway) Cuddapah District; 2 miles from the Koduru
When established	1949
Whether research, multiplication or demonstration farm	Mainly research
State, University or private managed	Partly by the State and partly by the Indian Council of Agricultural Research
Annual rainfall, latitude, longitude and altitude	37 inches Alt. 642 feet
Soil type	Light to deep red loam
Programme of research	Rootstock trials for Citrus ; study of the performance of promising mango hybrids evolved at the Station, trials on the culture of grapevines, vegetables and some Citrus varieties

8. Government Model Orchards - *cum* - Nursery, Giddalur

Address and distance from Railway Station	Giddalur P.O. and R.S. Kurnool District; 2 miles from Giddalur (Southern Railways)
When established	1953
Whether research, multiplication or demonstration farm	Mainly a fruit demonstration farm and fruit nursery. But some preliminary research on vegetables and major fruits has just been initiated
State, University or private managed	State managed
Annual rainfall	25 inches
Soil type	Light to deep brown loams
Programme of research	Varietal collections of fruits and vegetables

9. Cashew Research Station, Bapatla

Address and distance from Railway Station	Bapatla P.O. and Railway Station (on the Madras- Calcutta mainline of Southern Railways) Guntur District—about 1½ miles from the Railway Station
When established	1955
Whether research, multiplication or demonstration farm	Mainly a research station
State, University or private managed	Partly financed by the State and partly by the Indian Council of Agricultural Research
Annual rainfall	36 inches

Soil type	Sandy
Programme of research	On various aspects of cashewnut growing and its successful propagation

10. Government Fruit Farm, Ramapachodavaram

Address and distance from Railway Station	Ramapachodavaram P.O. and RailwayStation Rajahmundry on the Madras-Calcutta main line. It is 34 miles from Rajahmundry Railway Station (in the agency area of East Godavari District)
When established	1955
Whether research, multiplication or demonstration farm	Mainly a demonstration farm, but preliminary research on varietal trials of fruits and vegetables is taken up
State, University or private managed	State managed
Annual rainfall	53 inches
Soil type	Deep red loams
Programme of research	Varietal trial of sub-humid tropical fruits, vegetables and spices

11. Agricultural Demonstration-*cum*-Research Farm, Yemmigannur

Address and distance from Railway Station	Agricultural Demonstration *cum* Research Farm, Yemmigannur (Kurnool District), 19 miles from Adoni Railway Station
When established	1955
Whether research, multiplication or demonstration farm	Demonstration-*cum*-research farm
State, University or private managed	State managed
Annual rainfall	25.24 inches
Soil type	Black red and mixed
Programme of research	1. Demonstration of better methods of mixed farming, dry irrigation and rotation of crops 2. To find out the suitability of different crops under irrigated conditions in the Tungabhadra Project area 3. Introduction and trial of different strains and varieties of paddy in wetlands, and wheat, cotton *Jonna*, *Korra*, groundnut, *ragi*, chillies, onions, vegetables, etc. under irrigated conditions alongside locals to fix up suitable strains for the project area 4. Manurial experiments to find out the optimum doses of manure for several crops and methods of application 5. Irrigational studies to find out the frequency of irrigations for cotton *Jonna* and experiments on duty of water for the different crops grown on the farm 6. Demonstrating and popularising vegetable cultivation 7. Multiplication and supply of improved seeds to the extent possible to the ryots of Tungabhadra Project Area

12. Agricultural Research Station, Samalkota

Address and distance from Railway Station	Samalkota, East Godavari District, Andhra Pradesh ; ½ mile from Samalkota Railway Starion
When established	1902
Whether research, multiplication or demonstration farm	Research
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	38.75 inches Lat. 17.03′ N Long. 82.1′ E Alt. 28.16 feet
Soil type	Heavy alluvial clays of high base status which crack deeply during dry weather

Programme of research	Pure line selection in *Sanna Basangi* for evolving quality rice; inter-strain hybridisation for improving the quality yield and correcting defects such as chaffiness in the earhead, poor quality rice, etc. Studies on the cultural and manurial aspects of rice to evolve suitable practices. Studies on the control of pests and diseases. Selection work for evolving shift-straw and fine quality rices from *indica. Japonica* cross progenies that respond to heavy manuring. Collection and maintenance of genetic stock, further hybridisation work with the local strains and introduction of desirable types in the locality. Studies on the influence of various weather phenomena on the growth incidences of pests and diseases and yield of rice and sugarcane in collaboration with the Director of Agricultural Meteorology, Poona. Multiplication and supply of coconut seedings of good pedigree

13. Coconut Research Station, Ambajipeta

Address and distance from Railway Station	Coconut Research Station, Ambajipeta, Rajahmundry R.S.
When established	1955
Whether research, multiplication or demonstration farm	Research station for coconut
State, University or private managed	Jointly financed by Indian Central Coconut Committee and Andhra Pradesh State Government
Annual rainfall, latitude, longitude and altitude	About 48.89 inches (Average for 6 years) Long. 82° Lat. 16°35′ Alt. 14.05 above sea level
Soil type	Black clay
Programme of research	The primary object of this is to conduct on a regional basis co-ordinated research on the agronomical problems particularly inter-cultivation and manuring The following are the chief items on the programme of work of the Station: (1) Introduction of economic varieties (indigenous and exotic), (2) inter-cultivation trial, (3) manurial trial, (4) fertilizer placement trial, (5) Rhinoceros beetle control trial, (6) plantation performance of selected progenies of coconut seedlings, (7) green manure trial, (8) inter cropping trial, (9) supply of selected coconut seedlings

14. Agricultural Demonstration-*cum*-Research Station, Ragolu

Address and distance from Railway Station	Agricultural Demonstration *cum* Research Station, Ragolu, Srikakulam District, 5½ miles to Srikakulam Road Railway Station
When established	1956
Whether research, multiplication or demonstration farm	Research-*cum*-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	48.01 inches (Average for the last 5 years) Lat. 18°—20′ Long. 83°—54′ Alt. 99 feet above sea level
Soil type	Sandy loam
Programme of research	(*i*) Evolution of high yielding strains in the following crops: Paddy main season Paddy early and late season } *Oryza sativa* *Ragi* in three seasons *Eleusine coracana Gaertn.* *Sorghum* (yellow grain) *Sorghum durra* *Sajja*

Groundnut	*Arachis hypogea*
Gingelly	*Seasamum indicum*
Gogu	*Hibiscus sabdariffa*
Green gram and black gram.	*Phaseolus sp.*

(*ii*) Introduction and trial of strains and advanced cultures of the above crops from other research stations in the State,

(*iii*) Cultural and manurial trials on paddy *jonna* and *sajja* to find out optimum time for sowing and method of planting and optimum doses of manures and fertilisers

15. Governmental Experimental Farm, Dindi Project

Address and distance from Railway Station	Dindi Project, Deverkonda taluk, Nalgonda District 50 miles from Jadcherla Railway Station
When established	1949
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	26—20 inches Lat. 16°—32′ N Long. 78°—41′ E Alt. 1300 feet
Soil type	Sandy (Chalka)
Programme of research	Individual plant selection, preliminary yield test, varietal tests, new acquisition studies with cultures acquired and collected all over India on paddy Manurial and cultural studies on paddy, varietal tests and seed multiplication of *jowar* and castor HC 6.

16. Government Main Agricultural Farm, Warangal

Address and distance from Railway Station	Warangal, District Hyderabad, 8 miles from Warangal Railway Station
When established	1933
Whether research, multiplication or demonstration farm	Research-*cum*-seed multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	34 inches Lat. 18.01° N Long. 39.34° E Alt. 811 feet
Soil type	Sandy loam and clayey loam
Programme of Research	(*a*) Varietal tests on paddy, *jowar* and pulses (*b*) Manurial tests (*c*) Cultural tests on paddy and *jowar*, cotton and maize (*d*) Seed multiplication

17. Tobacco Research Station, Madhira

Address and distance from Railway Station	Madhira, District Khammam, 1/2 furlong from Madhira Railway Station
When established	1945
Whether research, multiplication or demonstration farm	Research Station
State, University or private managed	State managed
Annual rainfall	33 inches
Soil type	Black soil
Programme of research	Following experiments are on the programme: (*a*) Topping of country tobacco (*b*) Topping of Virginia tobacco (*c*) Rotation experiment (*d*) Texture of seed bed (*e*) Time of transplantation experiment (*f*) Finding out suitable rotation crop for tobacco

18. Maize Research Station, Karimnagar

Address and distance from Railway Station	Karimnagar, District Karimnagar
When established	1952
Whether research, multiplication or demonstration farm	Research Station
State, University or private managed	State and Indian Council of Agricultureal Reseaach
Annual rainfall	32 inches
Soil type	Sandy loams
Programme of research	*Hybridisation*: (*a*) Top crossing the inbreds and testing them for combining ability of inbreds (*b*) Making single crosses of inbreds of better combining ability and testing them (*c*) Trial of foreign hybrids (*d*) Manurial and cultural experiments (*e*) Time of sowing experiment (*f*) Seed multiplication

19. Agronomic Trials Research Station, Chalvoi

Address and distance from Railway Station	Chalvoi, Taluka Mulug, District Warangal
When established	1956
Whether research, multiplication or demonstration farm	Research Station
State, University or private managed	State
Annual rainfall	35 inches
Soil type	Loams to clayey loams
Programme of work	Model Agronomic experiments (*a*) Time of application of fertilizers (*b*) Placement of fertilizers (*c*) Cultural practices on fertilizers application (*d*) Residual value of phosphates

20. Agricultural Research Station, Rudrur

Address and distance from Railway Station	Rudrur, Bodhan taluka, District Nizamabad, 5 miles from Bodhan Railway Station
When established	1931
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	38 inches Lat. 18.38° N Long. 77.51° E Alt. 1325 feet
Soil type	Black cotton sandy clay and red loam
Programme of research	Research on all agricultural problems with special emphasis on paddy and sugarcane

21. Agricultural College Farm, Bapatla

Address and distance from Railway Station	Bapatla, District Guntur, Andhra Pradesh ; 1½ miles from Bapatla Railway Station
When established	1950
Whether research, multiplication or demonstration farm	Research and demonstration farm
State, University or private managed	State managed
Programme of research	Cultural, varietal and manurial experiments on fruits, paddy, sugarcane, *ragi*, pulses, oilseeds, fibres, etc.

22. Agricultural Research Station, Anakapalle

Address and distance from Railway Station	Anakapalle, District Vizagapattam, Andhra Pradesh ; 1 mile from Anakapalle Railway Station
When established	1913
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed

Annual rainfall, latitude, longitude and altitude	39 inches Lat. 17.41° N Long. 83.30° E Alt. 88 feet
Soil type	Red loam
Programme of research	Sugarcane, paddy, millets

23. Agricultural Research Station, Lam

Address and distance from Railway Station	Lam, District Guntur, Andhra Pradesh ; 6 miles from Guntur Railway Station
When established	1922
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	33 inches Alt. 105 feet
Soil type	Black, clayey
Programme of research	Breeding of corriander is in progress, research on cotton millets, tobacco and chillies is also carried on

24. Agricultural Research Station, Maruteru

Address and distance from Railway Station	Maruteru, District West Godavari, Andhra Pradesh ; 9 miles from Palakol Railway Station
When established	1925.
Whether research, multiplication or demonstration farm	Research-*cum*-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	42 inches Lat. 16.38° N Long. 81.44° E Alt. 20 feet
Soil type	Heavy clay
Programme of research	Pure line selections of local varieties of rice; inter strain hybridisation for higher yields and better quality; manurial and agronomical studies; control of pests

25. Agricultural Research Station, Nandyal

Address and distance from Railway Station	Nandyal, District Kurnool, Andhra Pradesh ; 2 miles from Nandyal Railway Station
When established	1906
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	28 inches Lat. 15.30° N Long. 78.30° E Alt. 690 feet
Soil type	Heavy black clay soils
Programme of research	Manurial and varietal trials on *Sorghum* and experiments on disease control

26. Cocanada Cotton Breeding Station, Narasaropet

Address and distance from Railway Station	Narasaropet, District Guntur, Andhra Pradesh ; 1 mile from Narasaropet Railway Station
When established	1940
Whether research, multiplication or demonstration farm	Research station
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	28 inches Lat. 16° N Long. 80° N Alt. 1000 feet
Soil type	Black loam
Programme of research	Selection of better variety of cotton

27. Deep Water Rice Station, Pulla

Address and distance from Railway Station	Pulla, District West Godavary, Andhra Pradesh; 5 miles from Railway Station Pulla
When established	1950
Whether research, multiplication or demonstration farm	Research farm
State University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	40 inches Lat. 17° N Long. 82° E Alt. 3 feet
Soil type	Clayey loam
Programme of research	Breeding, varietal, cultural and manurial trials on different varieties of paddy

28. Demonstration-*cum*-Exploratory Agricultural Station, Araku Valley

Address and distance from Railway Station	Araku Valley P.O., District Visakhapatnam, Andhra Pradesh; 72 miles from Waltair Railway Station
When established	1946
Whether research, multiplication or demonstration farm	Research seed multiplication and demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	54 inches Lat. 180° N Long. 82° E Alt. 3,000 feet
Soil type	Red loam
Programme of research	Introduction and trials of wet paddy, dry paddy and *ragi* (*Elusine coracana*) varieties from the plains and comparison with the local ones to find out varieties suitable for the valley. Manurial trials on paddy. Trials on potato, vegetable crops and fruit trees, cinnamon, spices and beverage crops

29. Demonstration Farm, Panagal

Address and distance from Railway Station	Panagal, P.O. Kalahasti, 1 mile and 2 furlongs from Kalashasti Railway Station
When established	1924
Whether research, multiplication or demonstration farm	Demonstration farm
State, University or private managed	State managed

30. Regional Millet Station, Peddapuram

Address and distance from Railway Station	Peddapuram, District East Godavari, Andhra Pradesh ; 3 miles from Samalkot Railway Station
When established	1951
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Programme of research	Evolution of strains in millets suitable for the tract

31. Regional Millet Station, Ongole

Address and distance from Railway Station	Ongole, District Guntur, Andhra Pradesh ; ½mile from Ongole Railway Station
When established	1949
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	35 inches Lat. 15.5° N Long. 80.2° E Alt. 80 feet
Soil type	Loam
Programme of research	Selection of suitable local strains; manurial and varietal trials on *Sorghum* species and common millet

32. Rice Research Station, Buchireddipalem

Address and distance from Railway Station	Buchireddipalem, District Nellore, Andhra Pradesh, 9 miles from Kodavalur Railway Station
When established	1937
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	38 inches Lat. 14.55° N Long. 79.88° E Alt. 40 feet
Soil type	Sandy loam
Programme of research	Studies on selection and hybridisation to improve paddy varieties, blast disease, dry ploughing and manurial and cultural trials

33. Sugarcane Research Station, Anakapalle

Address and distance from Railway Station	Anakapalle, District Visakhapatnam, Andhra Pradesh, 4 furlongs from Anakapalle Railway Station
When established	1913
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Programme of research	Intensive research on sugarcane and rice in the Divisions of Agronomy, Chemistry, Physiology, Mycology and Entomology.

ANDHRA PRADESH
ANIMAL HUSBANDRY RESEARCH STATIONS

1. Cattle Breeding Farm, Rajendranagar

Address and distance from Railway Station	Rajendranagar; 8 miles from Rajendranagar Railway Station
When established	1938
State, University or private managed	State managed
Programme of research	Selective breeding of Deoni cattle and Marathwada buffaloes for increasing milk production. Augmenting supply of pure milk to the local people and Government hospitals

2. Cattle Breeding Farm, Karimnagar

Address and distance from Railway Station	Karimnagar, 24 miles from Peddapalli Railway Station
When established	1951
State, University or private managed	State managed
Programme of research	1. Selective breeding of Malvi cattle to increase milk yield 2. Supply of wholesome milk to public

3. Government Dairy-*cum*-bull Farm, Visakhapatnam

Address and distance from Railway Station	Visakhapatnam, Hanumanthavaka Post, Andhra Pradesh; 4 miles from Waltair Railway Station
When established	1948
State, University or private managed	State managed
Programme of research	Selective breeding of Murrah buffaloes to evolve a high yielding strains

4. Government Livestock Farm, Guntur

Address and distance from Railway Station	Guntur, 5 miles from the Railway Station Guntur
When established	1941
State, University or private managed	State managed
Programme of research	1. Augmenting milk supply to local people, hospitals and hostels 2. Study of the adaptability of Murrah buffaloes under conditions prevailing in Guntur. Increasing the production of Murrah buffaloes by selective breeding, supply of pure milk to local people and institutions

5. Government Livestock Farm, Chintaladevi

Address and distance from Railway Station	36 miles from Kavali Railway Station
State, University or private managed	State managed
Programme of research	Breeding operations to improve the milk yield and to produce high quality breeding bulls in case of Ongole breed

6. Cattle-*cum*-Dairy Farm, Banavasi

Address and distance from Railway Station	Banavasi, District Kurnool; 16 miles from Adoni K.V. Railway Station
State, University or private managed	State managed
Programme of research	1. Supply of milk to public 2. Breeding operations to produce high quality Halika bulls and Murrah bulls 3. Study of adaptability of Murrah buffaloes under dry conditions of Rayalsema

7. Livestock Farm, Mahanandhi

Address and distance from Railway Station	Nandyal Taluqa, District Kurnool; 2 miles from Gajulapalli Railway Station
State, University or private managed	State managed
Programme of research	Breeding operations to revive near extinct Dupadu breed and breeding operations with Ongole, Gir breeds of cattle

8. Livestock Farm, Palmaniar

Address and distance from Railway Station	Palmaniar, Chittoor District
State, University or private managed	State managed
Programme of research	To revive the almost extinct Punganoor breed by selective breeding

9. Livestock Farm, Chintapalli

Address and distance from Railway Station	Vizagapatnam
State, University or private managed	State managed
Programme of research	To educate the hillmen in livestock feeding, breeding, management and general dairying

10. Cattle Salvage Farm, Saroornagar

Address and distance from Railway Station	Saroornagar, Post Hyderabad; 5 miles from Dabirpura Railway Station
When established	1955
State, University or private managed	State managed
Programme of research	To salvage the dry cattle and to encourage people to rear milk cattle in urban areas

11. 1. Sheep Seed Farm, Lepakshi
2. Sheep Seed Farm, Gonemekalapalli
3. Sheep Seed Farm, Kurbarapalli

State, University or private managed	State managed
Programme of research	To intensify breeding operations to multiply existing black faced white bodied Bellari breed and to educate the ryots on matters relating to sheep husbandry

12. Sheep Breeding Farm, Mahboobnagar

Address	Mahboobnagar, Andhra Pradesh
When established	1947
State, University or private managed	State managed
Programme of research	Up-grading local sheep with Bikaner rams to improve wool quality

13. District Poultry Farm, Chittoor

Address	Chittoor District
State, University or private managed	State managed
Programme of research	1. To disseminate knowledge on poultry husbandry to public 2. To supply eggs and birds of exotic breeds to public

14. District Poultry Farm, Cuddapah

Address	Cuddapah
State, University or private managed	State managed
Programme of research	1. To disseminate knowledge on poultry husbandry to public 2. To supply eggs and birds of exotic breeds to public

15. Poultry Farm attached to the Government Dairy Farm, Vishakapatnam

Address and distance from Railway Station	Poultry farm attached to the Government Dairy Farm, Vishakapatnam, 6 miles from waltair Railway Station
State, University or private managed	State managed
Programme of research	1. To disseminate knowledge on poultry husbandry to public 2. To supply eggs and birds of exotic breeds to public

16. Central Poultry Farm, Sitarampet

Address and distance from Railway Station	Sitarampet; 3 miles from Nampalli Railway Station
When established	Transferred from Agriculture Department in 1948
State, University or private managed	State managed
Programme of research	1. To disseminate knowledge on poultry husbandry to public 2. To supply eggs and birds of exotic breeds to public

17. Veterinary Disease Investigation Laboratory, Mallapalli

Address and distanee from Railway Station	Mallapalli lines Hyderabad; 3 miles from Nampalli Railway Station
When established	1932
State, University or private managed	State managed
Programme of research	Investigation and research on the diseases of livestock other than sheep, goat and poultry

18. Disease Investigation Laboratory, Guntur

Address and distance from Railway Station	Guntur; Guntur Railway Station
State, University or private managed	State managed
Programme of research	Investigation and research on the diseases of sheep and goats

19. Disease Investigation Laboratory (Poultry), Guntur

Address and distance from Railway Station	Guntur; Guntur Railway Station
State, University or private managed	State managed
Pogramme of research	Investigation and research on poultry.

ASSAM

AGRICULTURAL RESEARCH STATIONS

1. Agricultural Research Laboratory, Jorhat

Address and distance from Railway Station	Jorhat, District Sibsagar, 2½ miles from Jorhat town
When established	1923
Whether research, multiplication or demonstration farm	Research and multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	84 inches Lat. 26.7° N Long. 94.2° E Alt. 250 feet above sea level
Soil type	Sandy loam
Programme of research	Varietal, cultural and manurial trials on cotton, jute, paddy, tapioca, rhea, sweet potato, chillies, linseed, mustard, pea, etc.

2. Bao and Boro paddy Research Station, Nowgong

Address and distance from Railway Station	District Nowgong, 3 miles from Chaparmukh
When established	1948
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	Lat. 26.25° N Long. 92.65° E
Soil type	Clayey loam
Programme of research	Varietal trials on *bao* paddy and *boro* paddy. Works are also in progress on *ahu*, jute and *sali*

3. Research Farm, Garo Hills

Address and distance from Railway Station	Garo Hills, Assam; 74 miles from Dhubri Railway Station
When established	1947
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	130 inches Lat. 25.31° N Long. 90.14° E Alt. 1215 feet
Soil type	Red sandy clay soil
Programme of research	Selecting good quality cotton by varietal experiments

4. Research-*cum*-Multiplication Farm, Kokilamukh

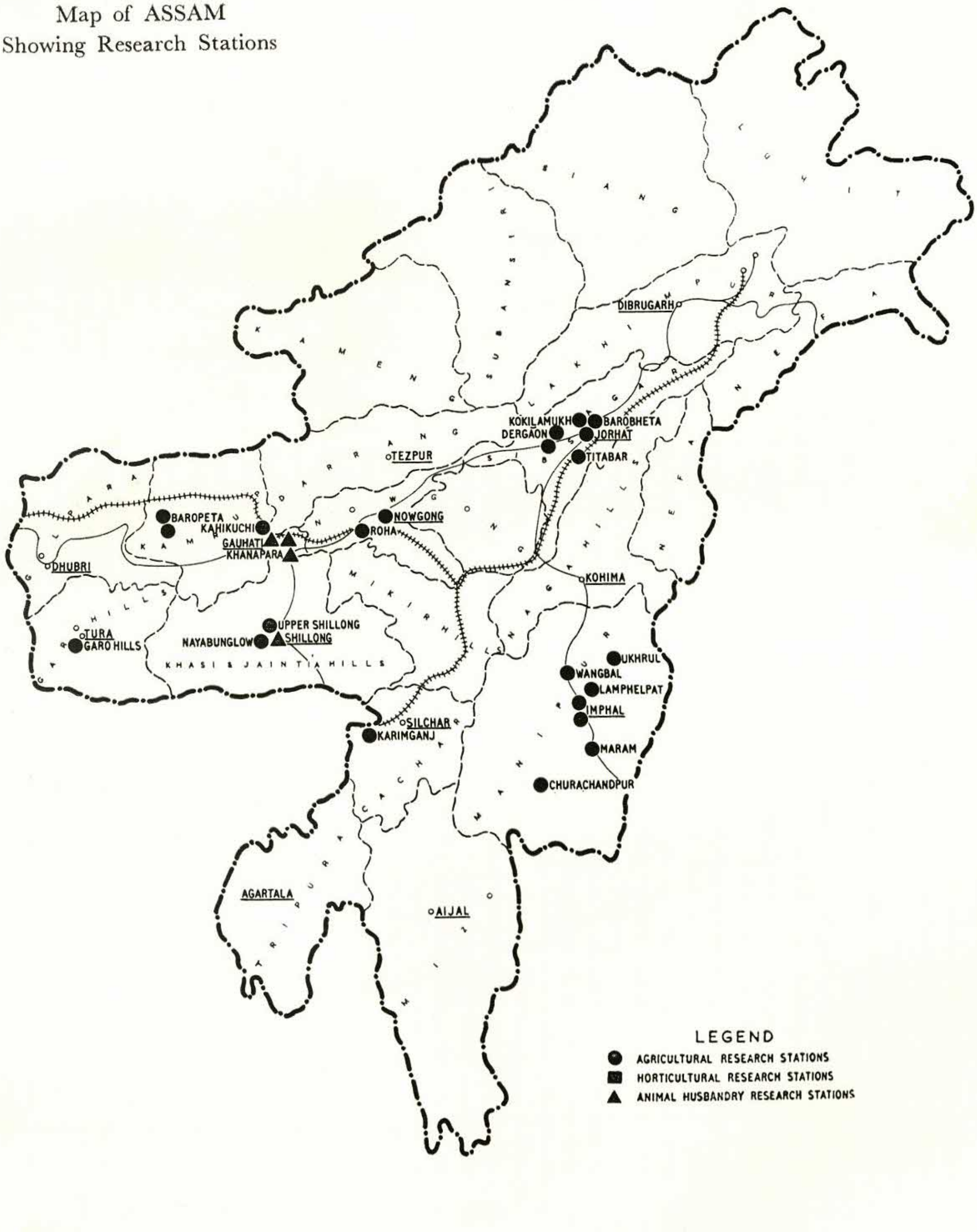
Address and distance from Railway Station	Kokilamukh, District Sibsagar, Assam; 7½ miles from Jorhat town
When established	1951
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	112 inches Lat. 26.7° N Long. 94.2° E Alt. 150 feet above sea level
Soil type	Sandy loam
Programme of research	Manurial, cultural and varietal experiments on mustard, sann-hemp and *ahu* paddy

5. Rice Experiment Station, Karimganj

Address and distance from Railway Station	Karimganj, District Cachar, 5 miles from Karimganj
When established	1913
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm

[PLATE LXVII

Map of ASSAM
Showing Research Stations



State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	144 inches Lat. 24.5° N Long. 92.5° E
Soil type	Sandy, clay loam
Programme of research	Manurial cultural experiments on paddy and jute

6. Rice Experimental Station, Titabar

Address and distance from Railway Station	Titabar, District Sibsagar, 3 miles from Titabar
When established	1922
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	85 to 88 inches Lat. 94.25° N Long. 26.7° E
Soil type	Heavy clayey loam
Programme of research	Selection of promising strain of paddy and manurial experiment. Works are also in progress on jute, banana, pulses, bamboo, pineapple and jute

7. Flood Resistant Varieties of Paddy Research Station, Roha

Address and distance from Railway Station	Roha, District Nowgong, 3 miles from Chaparmukh
When established	1953
Whether research, multiplication or demonstration farm	Research
State, University or private managed	State managed
Programme of research	To evolve high-yielding flood resistant varieties of paddy possessing desirable qualities by breeding and selection so that these may be released to the cultivators of flood affected areas

8. Coconut Research Nursery, Kahikuchi

Address and distance from Railway Station	Kahikuchi, District Kamrup, 5 miles from Gauhati town
When established	1951
Whether research multiplication or demonstration farm	Research and multiplication
State, University or private managed	State managed
Programme of research	To bring out a rapid expansion of area under coconut cultivation in Assam by large-scale distribution of quality seedlings raised in the nursery and to establish the cultivation on a plantation basis and to induce the growers to take to better cultural and manurial practices

9. Multiplication of Improved Strains of Mustard, Baropeta

Address and distance from Railway Station	Baropeta, District Kamrup, 3 miles from Baropeta Road
When established	1953
Whether research, multiplication or demonstration farm	Multiplication farm
State, University or private managed	State managed
Programme of research	To multiply improved strains of mustard with a view to increase the area and production of mustard in Assam by gradual elimination of poor yielding varieties

10. High Altitude Paddy Research Station, Upper Shillong

Address and distance from Railway Station	Upper Shillong, District K. and J. Hills, 5 miles from Shillong
When established	1953
Whether research, multiplication or demonstration farm	Research
State, University or private managed	State managed
Programme of research	To evolve high yielding improved varieties of high altitude paddy which could be further multiplied through the registered growers for distribution among the growers

11. Ginger Research Station, Nayabunglow

Address and distance from Railway Station	Nayabunglow, District K. and J. Hills, 14 miles from Shillong
When established	1954
Whether research, multiplication or demonstration farm	Research and multiplication
State, University or private managed	State managed
Programme of research	To evolve high yielding varieties of improved ginger with qualitative aroma and medicinal properties by selection and find out their agronomical requisites

12. Composite Research Station for Pepper, Cardamom and Cashewnut, Dergaon

Address and distance from Railway Station	Dergaon, District Sibsagar, 16 miles from Jorhat town
When established	1956
Whether research, multiplication or demonstration farm	Research farm
Stare, University or private managed	State managed
Programme of research	To expand the cultivation of pepper, cardamom, cashewnut, particularly to introduce these crops to the State

13. Cigarette Tobacco Research Station, Boropeta

Address and distance from Railway Station	Boropeta, District Kamrup, Assam ; 3 miles from Baropeta Road
When established	1954
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Programme of research	To open out new possibilities for the crop to develop in Assam by inducing the growers to take up scientific way of cultivation of the crop and the curing of beans under controlled conditions of temperature

14. Arecanut Research Nursery, Barobheta

Address and distance from Railway Station	Barobheta, Jorhat ; District Sibsagar, Assam ; 3 miles from Jorhat
When established	1951
Whether research, multiplication or demonstration farm	Research and multiplication farm
State, University or private managed	State managed
Programme of research	To raise quality arecanut seedlings from selected areca trees for large-scale distribution among the growers and to improve the yield in the existing plantation by inducing the growers to take to better cultural and manurial practices, etc.

15. Sugarcane Research Station, Barobheta

Address and distance from Railway Station	Barobheta, Jorhat ; Now being shifted to Dergaon. District Sibsagar, 3 miles from Jorhat
When established	1947
Whether research, multiplication or demonstration farm	Research-*cum* multiplication farm
State, University or private managed	State
Programme of research	To carry out varietal manurial, experiments and agronomical research on sugarcane more elaborately and multiply recommended types of cane on expansive basis for large-scale distribution among the growers.

ASSAM

ANIMAL HUSBANDRY RESEARCH STATIONS

1. Bovine Contagious Pleuro Pneumonia Scheme, Gauhati

Address and distance from Railway Station	Gauhati, District Kamrup 1 mile from Gauhati Railway Station
When established	1951
Whether research or demonstration farm	Research farm
State, University or private managed	State managed
Programme of research	Control, determination of curative and preventive measures

2. Cross Breeding in hilly and heavy rainfall areas, Shillong

Address and distance from Railway Station	Shillong, K. and J Hills District 63 miles from Gauhati Railway Station
When established	1956
Whether research or demonstration farm	Research farm
State, University or private managed	State managed
Programme of research	Up-grading of hill cattle

3. Cattle Nutrition Scheme, Khanapara

Address and distance from Railway Station	Khanapara, Gauhati District-Kamrup ; 7 miles from Gauhati Railway Station on Gauhati-Shillong Road
When established	1939
Whether research or demonstration farm	Research farm
State, University or private managed	State managed
Programme of research	Research on balanced nutrition of local cattle.

BIHAR

AGRICULTURAL RESEARCH STATIONS

1. Agricultural Research Institute, Sabour

Address and distance from Railway Station	P.O. Sabour, District Bhagalpur, adjacent to Sabour Railway Station
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	39 inches Lat. 25.15° N Long. 87.04° E
Soil type	Loam
Programme of research	Research work on crops in all subjects such as Agronomy, Botany, Agricultural chemistry, Entomology and Plant Pathology. Horticultural research including fruit preservation and soil survey work are also located on this Institute

2. Sub-divisional Farm, Banka

Address and distance from Railway Station	Banka, District Bhagalpur about six miles from Barahat Railway Station
Whether research, multiplication or demonstration farm	Experimental, multiplication and demonstration farm
State, University or private managed	State managed
Annual rainfall	40 inches
Soil type	Clayey with gangal
Programme of research	Agronomical, varietal and manurial trials

3. District Farm, Monghyr

Address and distance from Railway Station	Monghyr, 2 miles from Monghyr Railway Station
Whether research, multiplication or demonstration farm	Research and multiplication farm
State, University or private managed	State managed
Soil type	Clay loam
Programme of research	Agronomical, varietal and manurial trials

4. Sub-divisional Farm, Jamui

Address and distance from Railway Station	Jamui, District Monghyr, about a mile from Jamui Railway Station
When established	1925
Whether research, multiplication or demonstration farm	Experimental, demonstration and multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	44 inches Lat. 24.83° N Long. 86.28° E Alt. 100 feet above sea level
Soil type	Clayey loam with admixture of limestone
Programme of research	Agronomical, varietal and manurial trials

5. District Farm, Dumka

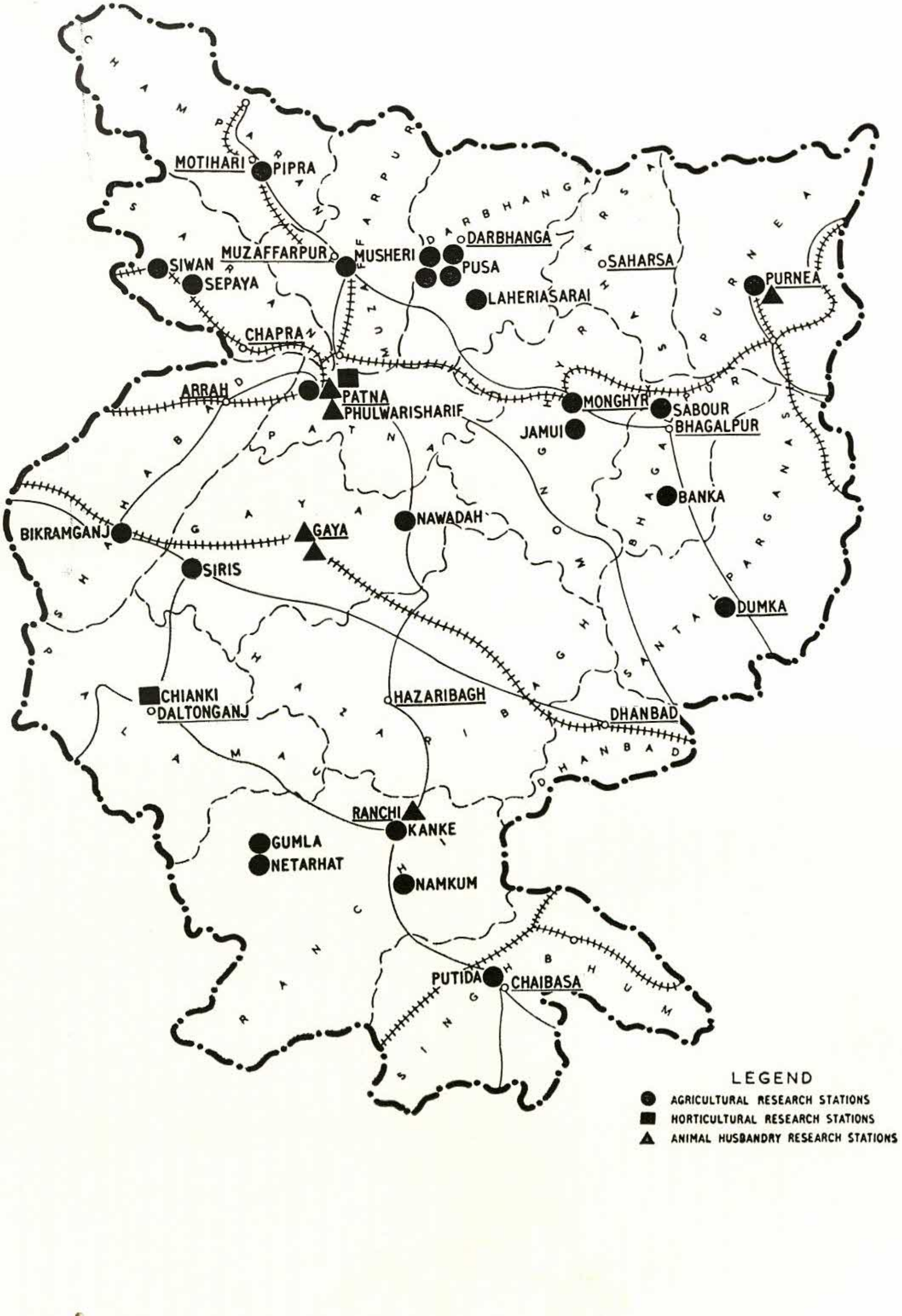
Address and distance from Railway Station	Dumka, District Santhal Parganas, nearest Railway Station Deogarh
Whether research, multiplication or demonstration farm	Research and multiplication
State, University or private managed	State managed
Soil type	Clayey
Programme of research	Agronomical, varietal and manurial trials

6. District Farm, Purnea

Address and distance from Railway Station	Purnea; about ½ mile from Purnea Railway Station
When established	1952
Whether research, multiplication or demonstration farm	Research and multiplication farm

[PLATE LXVIII

Map of BIHAR
Showing Research Stations



State, University or private managed	State managed
Soil type	Loam
Programme of research	Agronomical, varietal and manurial trials

7. Sugarcane Research Institute, Pusa

Address and distance from Railway Station	Pusa, District Darbhanga, 7 miles from Pusa Road Railway Station
When established	1932
Whether research, multiplication or demonstration farm	Research
State, University or private managed	State managed, and partly financed by Indian Central Sugarcane Committee
Annual rainfall, latitude, longitude and altitude	45 inches Lat. 26° N Long. 85.75° E Alt. 160 feet
Soil type	Loam
Programme of research	All research work bearing on different aspects of the cane crop is represented by different sections of Agronomy, Botany, Physiology, Chemistry, Entomology, Pathology and Statistics. Special features of work relate to varietal nutritional and cultural work in relation to various strucutural peculiarities of varieties and disease resistance ; breeding of new varieties, early indication characters for tonnage and sucrose content

8. Agricultural Research Institute, Pusa

Address and distance from Railway Station	Pusa, District Darbhanga; 7 miles from Pusa Road Railway Station
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	45 inches Lat. 26° N Long. 85.75° E Alt. 160 feet above sea level
Soil type	Loam
Programme of research	The Institute was recently set up for research work on all aspects of improvement of crops such as maize and *rahar* and millet, paddy, wheat, oilseeds, pulses, vegetables, etc.

9. District Farm, Musheri

Address and distance from Railway Station	Musheri, District Muzaffarpur, 6 miles from Muzaffarpur Railway Station
When established	1932
Whether research, multiplication or demonstration farm	Experimental and multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	35 inches Lat. 26.7° N Long. 85.27° E
Soil type	Sandy loam
Programme of research	Agronomical, varietal and manurial trials

10. District Farm, Pipra (Jute Seed Multiplication Farm)

Address and distance from Railway Station	Pipra Kothi, District Motihari, 3 miles from nearest Railway Station Jiudhara
Whether research, multiplication or demonstration farm	Research and multiplication farm
State, University or private managed	State managed
Soil type	Loam
Programme of research	Agronomical trials

11. District Farm, Sepaya

Address and distance from Railway Station	Sepaya, District Saran, 6 miles from Sasamusa Railway Station

When established	1952
Whether research, multiplication or demonstration farm	Research and multiplication farm
State, University or private managed	State managed
Soil type	Loam
Programme of research	Agronomical, varietal and manurial trials

12. Sub-divisional Farm, Siwan

Address and distance from Railway Station	Siwan, District Saran; very close to Siwan Katchary Railway Station
When established	1926
Whether research, multiplication or demonstration farm	Experimental, multiplication and demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	39 inches Lat. 26.12° N Long. 84.20° E
Soil type	Sandy loam
Programme of research	Agronomical, varietal and manurial trials

13. Sub-divisional Farm, Laheriasarai

Address and distance from Railway Station	Laheriasarai, District Darbhanga; one mile from Laheriasarai Railway Station
When established	1926
Whether research, multiplication or demonstration farm	Experimental, multiplication and demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	40 to 50 inches Lat. 24.30° N Long. 84.20° E
Soil type	Loam
Programme of research	Agronomical, varietal and manurial trials

14. Agricultural Research Institute, Patna

Address and distance from Railway Station	Mithapur, Patna, Bihar; ½ mile from Patna Railway Junction
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Soil type	Clayey
Programme of research	This Research Station which was originally a sugarcane farm; has recently been converted into a research station for work on all crops including paddy, wheat, vegetables, sugarcane, pulses, oilseeds, etc. Sections of Plant Pathology, Entomology, Agricultural Chemistry and Agronomy are also attached to this Institute

15. Sub-divisional Farm, Nawadah

Address and distance from Railway Station	Nawadah, District Gaya, about two miles from Nawadah Railway Station
Whether research, multiplication or demonstration farm	Experimental, multiplication and demonstration farm
State, University or private managed	State managed
Soil type	Clayey
Programme of research	Agronomical, varietal and manurial trials

16. Sub-divisional Farm, Siris

Address and distance from Railway Station	Siris, Sub-division Aurangabad, District Gaya; about 11 miles from Pamarganj Railway Station
Whether research, multiplication or demonstration farm	Experimental, multiplication and demonstration farm
State, University or private managed	State managed
Soil type	Clayey
Programme of research	Some agronomical trials

17. Sub-divisional Farm, Bikramganj

Address and distance from Railway Station	Bikramganj, Sub-division Sasaram, District Shahabad; about two miles from Bikramganj Railway Station
Whether research, multiplication or demonstration farm	Experimental, multiplication and demonstration farm
State, University or private managed	State managed
Soil type	Clayey
Programme of research	Agronomical and varietal trials and irrigation experiments

18. Agricultural Research Institute, Kanke

Address and distance from Railway Station	Kanke, District Ranchi, 9 miles from Ranchi Railway Station
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	60 inches Lat. 23.23° N Long. 85.23° E Alt. 2164 feet
Soil type	Red laterite soil
Programme of research	The Institute has recently been established for research on agricultural problems of the Chhotanagpur region. The programme includes research on crops such as paddy, wheat, maize, barley, pulses, and oilseeds, etc. Soil fertility investigations, agronomical and agrostological research are also undertaken

19. Experimental Farm, Netarhat

Address and distance from Railway Station	Netarhat, P.O. Marwai, District Ranchi; 50 miles from Lohardaga Railway Station
When established	1920
Whether research, multiplication or demonstration farm	Research and multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	69 inches Alt. 3786 feet
Soil type	Red laterite soil
Programme of research	Agronomical and varietal trials

20. Sub-divisional Farm, Gumla

Address and distance from Railway Station	Gumla, District Ranchi; 32 miles from Lohardaga Railway Station
State, University or private managed	State managed
Whether research, multiplication or demonstration farm	Multiplication-*cum*-demonstration farm
Annual rainfall, latitude, longitude and altitude	50 inches Lat. 23° N Long. 81° E Alt. 2100 feet above sea level
Soil type	Red loam (upland)
Programme of research	Agronomical trials, multiplication and demonstration

21. Experimental Farm, Chianki

Address and distance from Railway Station	Chianki, District Palamau, Bihar; 3 miles from Daltonganj Railway Station
When established	1926
Whether research, multiplication or demonstration farm	Research and multiplication
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	42 inches Lat. 20.1° N Long. 84.15° E Alt. 1,000 feet
Soil type	Clayey

Programme of research	Agronomical trials, varieta trials and multiplication. Research on Citrus fruits

22. Sub-divisional Farm, Putida

Address and distance from Railway Station	Putida, P.O. Chaibassa, District Singhbhum, Bihar; 6 miles from Chaibassa Railway Station
When established	1925
Whether research, multiplication or demonstration farm	Multiplication and demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	50 inches Lat. 22.35° N Long. 85.50° E Alt. 800 feet
Soil type	Clayey (laterite soil)
Programme of research	Agronomical trials.

BIHAR

ANIMAL HUSBANDRY RESEARCH STATIONS

1. Livestock Research Station, Phulwarisharif

Address and distance from Railway Station	Phulwarisharif, P.O. Bihar Veterinary College; 4 miles from Patna Railway Station
Whether research, multiplication or demonstration farm	Research station
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	39.46 inches Long. 85.15° E Lat. 20.30° N Alt. 170 above sea level
Soil type	Clay loam
Programme of research	Research on animal diseases, sheep, goat and poultry diseases, fodder and grassland, genetics, nutrition and manufacture of biological products

2. Wool Analysis of Sheep in Bihar, Gaya

Address and distance from Railway Station	Tikuna Farm, P.O. Bodhgaya, Gaya
Whether research, multiplication or demonstration farm	Research station
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	44.96 inches Lat. 24.46° N Long. 84.47° E Alt. 400
Soil type	Heavy clay
Programme of research	Research on animal diseases, sheep, goat, poultry fodder and grassland, genetics, nutrition and manufacture of biological products

3. Sheep Breeding in Eastern Region, Gaya

Address and distance from Railway Station	Tikuna Farm, P.O. Bodhgaya, Gaya
Whether research, multiplication or demonstration farm	Research station
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	44.96 inches Lat. 24.46° N Long. 84.47° E Alt. 400
Soil type	Heavy clay
Programme of research	Research on animal diseases, sheep, goat and poultry diseases, fodder and grassland, genetics, nutrition and manufacture of biological products

4. Cross Breeding Research Centre, Ranchi

Address and distance from Railway Station	Cross Breeding Centre, Murhabadi Road, Ranchi
Whether research, multiplication or demonstration farm	Research station
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	51.62 inches Lat. 23.23° N Long. 85.2° E Alt. 2200
Soil type	Hilly soil with rocky bed
Programme of research	Research on animal diseases, sheep, goat and poultry diseases, fodder and grassland, genetics, nutrition and manufacture of biological products

5. Red Purnea Cattle Breeding Farm, Purnea

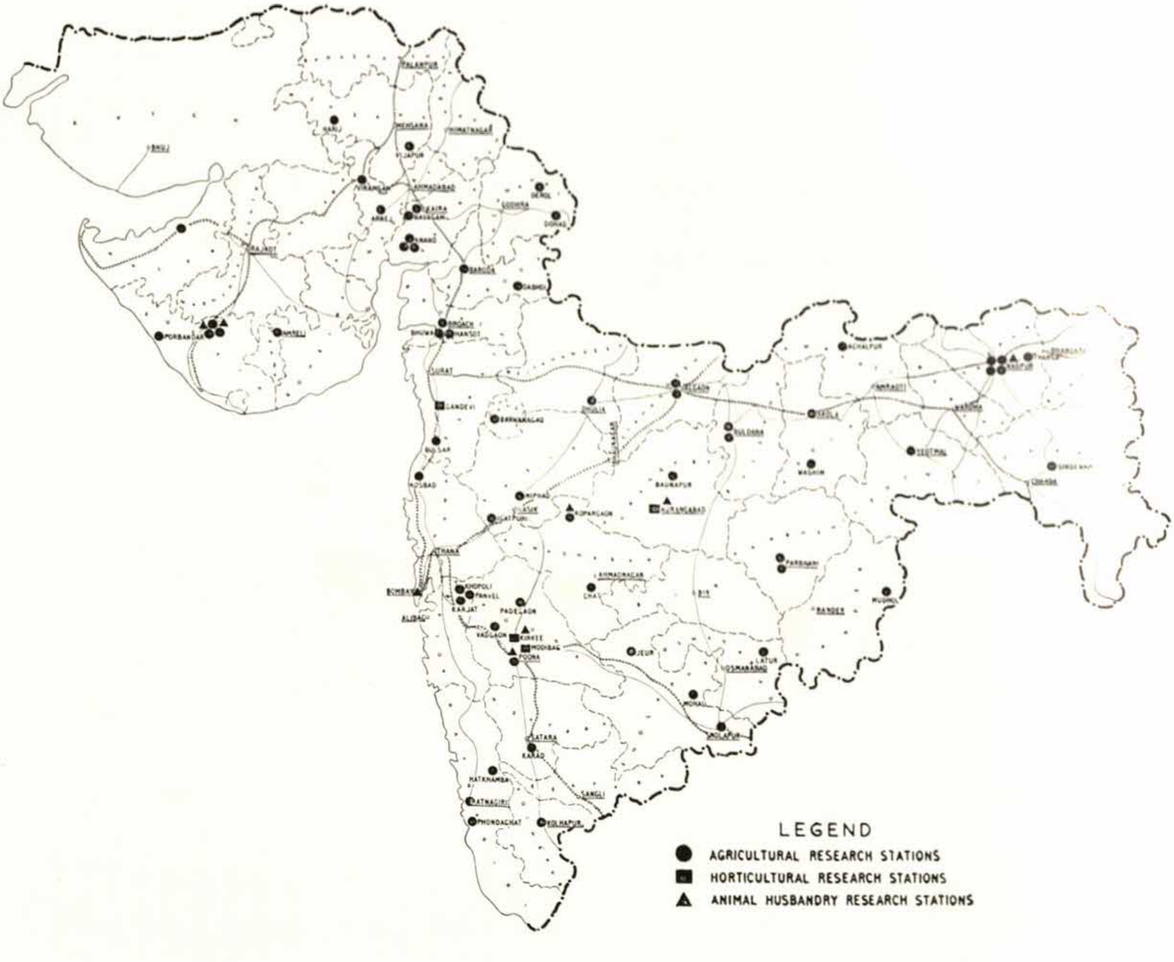
Address and distance from Railway Station	Red Purnea Cattle Breeding Farm, Purnea
Whether research, multiplication or demonstration farm	Research station

State, University or private managed	State managed
Annual rainfall, latitude,, longitude and altitude	54.20 inches Lat. 25.25° N Long. 87.28° E Alt. 115
Soil type	Calcareous sandy loam
Programme of research	Research on animal diseases, sheep, goat and poultry diseases, fodder and grassland, genetics, nutrition and manufacture of biological products

6. Cattle Sterility Research Centre, Bihar Veterinary College, Patna

Address and distance from Railway Station	P.O. Bihar Veterinary College, Patna
Whether research, multiplication or demonstration farm	Research station
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	39.46 inches Long. 85.15° E Lat. 20.30° N Alt. 170
Soil type	Clay loam
Programme of research	Research on animal diseases, sheep, goat and poultry diseases; fodder and grassland, genetics, nutrition and manufacture of biological products.

Map of BOMBAY
Showing Research Stations



BOMBAY

AGRICULTURAL RESEARCH STATIONS

1. Agricultural Research Station, Amreli

Address and distance from Railway Station	Amreli, District Amreli, Bombay four furlongs from Amreli Railway Station
When established	1926
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	18 inches Lat. 21.6° N Long. 71.3° E Alt. 400 feet from sea level
Soil type	Medium black
Programme of research	Breeding and hybridisation of *bajra*, selfing of *bajra*, *jowar*, wheat, paddy, cotton and groundnut

2. Agricultural Research Station, Arnej

Address and distance from Railway Station	Arnej, District Ahmedabad, Bombay ; 2 furlongs from Arnej Railway Station
When established	1944
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	18 inches Lat. 22.6° N Long. 72.2° E
Soil type	Deep black and medium black
Programme of research	Breeding and agronomical research on gram, wheat, *jowar* and linseed

3. Agricultural Research Station, Baroda

Address and distance from Railway station	Baroda, Bombay ; 1¼ miles from Baroda Railway Station
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude longitude and altitude	28 inches Lat. 22.17° N Long. 73.12° E Alt. 287 feet
Soil type	Sandy loam
Programme of research	Agronomical research on tobacco, cotton, *bajra*, *til*, castor and *tur*

4. Agricultural Research Station, Bhawanagad

Address and distance from Railway Station	Bhawangad, District Dang, Bombay ; 14 miles from Waghai Railway Station
When established	1953
Whether research, multiplication or demonstration farm	Research farm
State University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	65 inches Lat. 21° N Long. 74° E
Soil type	Loamy soils
Programme of research	To evolve early and high yielding strains of paddy, Kodra, Nagli and Vari

5. Agricultural Research Station, Bhuwa

Address and distance from Railway Station	Bhuwa, District Broach, Bombay ; 11 miles from Broach Railway Station
When established	1948

Whether research, multiplication or demonstration farm	Research, multiplication and demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	40 inches Lat. 21.40° N Long. 72.55° E Alt. about sea level
Soil type	Black cotton soil and basar soil
Programme of research	Research on *jowar*, *tur*, *til*, groundnut, cotton wheat and miscellaneous crops like sundhia

6. Agricultural Research Station, Broach

Address and distance from Railway Station	Broach, Bombay ; 1½ miles from Broach Railway Station
When established	1913
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	30 inches Lat. 22° N Long. 73.5° E Alt. 55 feet
Soil type	Black clayey cotton soil which cracks heavily in winter and summer
Programme of research	Breeding and agronomical trials on cotton

7. Agricultural Research Station, Bulsar

Address and distance from Railway Station	Bulsar, District Surat, Bombay ; 1 mile from Bulsar Railway Station
When established	1945
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	30 inches Lat. 20.35° N Long. 72.56° E Alt. 30 feet
Soil type	Medium black
Programme of research	Breeding and agronomical research on paddy and cotton

8. Agricultural Research Station, Chas

Address and distance from Railway Station	Chas, Bombay ; 7 miles from Ahamadnagar Railway Station
When established	1941
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	24 inches Lat. 19° N Long. 75° E Alt. 2217 feet.
Soil type	Medium light
Programme of research	Agronomical research on gram, *jowar*, wheat, groundnut and cereals

9. Agricultural Research Station, Dabhoi

Address and distance from Railway Station	Dabhoi, District Baroda, Bombay ; 1½ miles from Dabhoi Railway Station
When established	1937
Whether research, multiplication or demonstration farm	Multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	40 inches Lat. 22° N Long. 73° E Alt. 280 feet
Soil type	Clayey loam, black

Programme of research	Agronomical research on *jowar*, paddy, cotton and wheat

10. Agricultural Research Station, Dhulia

Address and distance from Railway Station	Dhulia, district West Khandesh, Bombay ; 2 miles from Dhulia Railway Station
When established	1947
Whether research, multiplication or demonstration farm	Research farm
State University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	24 inches Lat. 20.54° N Long. 74.47° E Alt. 866 feet
Soil type	Medium black about 1½ to 2 ft. deep with lime layer below, which causes poor drainage
Programme of research	Research on China-*mung*, black gram, soyabean, cotton, maize, *jowar*, groundnut and wheat

11. Agricultural Research Station, Dohad

Address and distance from Railway Station	Dohad, District Panchmahals, Bombay ; 3 miles from Dohad Railway Station
When established	1906
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	35 inches Lat. 23° N Long. 74° E Alt. 1001 feet
Soil type	Loam and clay loam
Programme of research	Research on groundnut, maize, paddy, and gram

12. Agricultural Research Station, Hatkhamba

Address and distance from Railway Station	Hatkhamba taluka, District Ratnagiri, Bombay ; 72 miles from Kolhapur Railway Station
When established	1920
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Programme of research	(*a*) Trials on selection of Nagali, Vari and Kodra on plot scale at the research station (*b*) District trials of promising selections of Nagali, Vari and *kodra* (*c*) Multiplication of improved strains of Nagali (*d*) Agronomic research on Nagali

13. Agricultural Research Station, Harij

Address and distance from Railway Station	Harij, Mehsana District, Bombay ; 1½ miles from Harij Railway Station
When established	1940
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Programme of research	Trials of different intervals of drainage, *i.e.*, at a distance of 100 ft.—150 ft. and 300 ft. apart to leach out excess of soluble salts, are being conducted on the farm. For this 12 plots have been selected with four replications, namely ; (1) *Jowar* plus *chola* (2) *Bajri* plus *guar* (3) *Banli* plus *moth* (4) wheat plus gram. Each rotation is followed in same replicate separately

14. Agricultural Research Station, Igatpuri

Address and distance from Railway Station	Igatpuri, District Nasik, Bombay
When established	1941

Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	125 inches Lat. 20° N Long. 74° E Alt. 1922 feet
Programme of research	Breeding and agronomical research on paddy, pulses, etc.

15. Agricultural Research Station, Jalgaon

Address and distance from Railway Station	Jalgaon, Diistrict East Khandesh Bombay ; 2 miles from Jalgaon Railway Station
When established	1913
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Programme of research	Work on *jowar*, groundnut and pulses (*urd* and *mung*)

16. Agricultural Research Station, Jeur

Address and distance from Railway Station	Jeur, District Sholapur, Bombay ; 2½ miles from Jeur Railway Station
When established	1941
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall	19 inches
Soil type	Loam
Programme of research	Agronomical research on wheat, *jowar*, *bajri*, gram and groundnut

17. Agricultural Research Station, Karad

Address and distance from Railway Station	Karad, District North Satara, Bombay ; 5 miles and two furlongs from Karad
When established	1948
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	28 inches Alt. 1944 feet
Soil type	Clayey loam
Programme of research	Breeding and agronomical research on *jowar*, *bajri*, gram, groundnut and *methi*

18. Agricultural Research Station, Karjat

Address and distance from Railway Station	Karjat, District Kolaba Bombay, Karjat Railway Station (on Central Railway) on Bombay-Poona main line
When established	1919
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	134 inches Lat. 18.55° N Long. 73.18° E Alt. 169 feet
Soil type	Soils situated on the upper levels along the hill slopes are poor in fertility, shallow, coarse and well drained. At lower levels are the typical rice soils deep and clay-loam
Programme of research	Breeding and agronomical research on jute, rice, Nagli and Vari

19. Agricultural Research Station, Khopoli

Address and distance from Railway Station	Khopoli, District Kolaba, Bombay ; 9 miles from Karjat Railway Station which is situated on Poona-Bombay route
When established	1951
Whether research, multiplication or demonstration farm	Multiplication-*cum*-demonstration farm
State, University or private managed	State managed

Annual rainfall, latitude, longitude and altitude	125 to 150 inches Lat. 18.91° N Long. 73.31° E Alt. 235 feet
Soil type	The soils are chiefly derived from trap rock and vary from medium to light black types
Programme of research	Agronomical research on paddy and vegetables, *viz.* brinjals, tomatoes and chillies

20. Agricultural Research Station, Kolhapur

Address and distance from Railway Station	Kolhapur, Bombay; 2 miles from Kolhapur Railway Station
When established	1947
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Programme of research	(*a*) To have a thorough survey of rice varieties (*b*) To conduct yield trials of improved strains of paddy from other farms and to know their suitability to the tract (*c*) To bring about improvement in local varieties of paddy by genetic methods (*d*) To conduct agronomic experiments to get valuable information regarding manurial doses and cultural practices (*e*) To evolve a variety resistant to ' blast ' disease by hybridisation

21. Agricultural Research Station, Kopargaon

Address and distance from Railway Station	Kopargaon, District Ahmednagar, Bombay ; 3½ miles from Kopargaon Railway Station
When established	1915
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	20 inches Lat. 19.5° N Long. 74.30° E Alt. 1790 feet
Soil type	Loam, clayey, loam-deep medium and chopan
Programme of research	Breeding and agronomical research on paddy, *jowar*, gram, wheat, sugarcane, *bajra* and groundnut

22. Agricultural Research Station, Kosbad

Address and distance from Railway Station	Kosbad, District Thana, Bombay ; 2½ miles south of Gholwad Station on Western Railway
When established	1953
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall	75 inches
Soil type	Clayey
Programme of research	Breeding and agronomical research on paddy

23. Agricultural Research Station, Mohol

Address and distance from Railway Station	Mohol, District Sholapur, Bombay, 4 miles from Mohol Railway Station
When established	1918
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	Lat. 17.75° N Long. 75.5° E Alt. 1500 feet
Programme of research	Breeding work is carried out in order to improve the strains genetically and to evolve high-yielding strains in *jowar*

(cereal) *mung*, *urd*, and gram (pulses) and safflower, groundnut, castor and linseed (oilseeds)

24. Agricultural Research Station, Navagam

Address and distance from Railway Station	Navagam, District Kaira, Bombay ; 11 miles from Barejdi Railway Station
When established	1945
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	25 inches Lat. 22.48° N Long. 72.38° E
Soil type	Clayey loam
Programme of research	Breeding and agronomical research on paddy

25. Agricultural Research Station, Niphad

Address and distance from Railway Station	Niphad, District Nasik, Bombay; ½ mile from Niphad Railway Station
When established	1932
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	24 inches Lat. 20.6° N Long. 74.7° E Alt. 1803 feet
Soil type	Clayey loam
Programme of research	Breeding and agronomical research on wheat, *bajri*, *tur*, gram, sesamum, safflower, pulses, oilseeds and vegetables, *viz*. sweet potato, onions, etc.

26. Agricultural Research Station (Central) Padegaon

Address and distance from Railway Station	Padegaon, District Poona, Bombay ; 4 miles from Nira Railway Station
When established	1932
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Programme of research	Research on sugarcane, *gur* manufacture, irrigation, agriculture, agronomy, soil, bio-chemistry, entomology, mycology including micro-biology

27. Agricultural Research Station, Panvel

Address and distance from Railway Station	Panvel, District Kolaba, Bombay ; Karjat Railway Station
When established	1943
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	Lat. 59° N Long. 73° E Alt. about sea level
Programme of research	Selection, breeding, hybridisation work, manurial trials in moderately saline fields, seed rate experiments, plant physiology experiments ; soil correcting experiment, district trials of promising strains, small and large-scale yield trials of improved strains evolved on the farm ; and weeds and pests control, are some of the important items under the existing programme of research

28. Agricultural Research Station, Phondaghat

Address and distance from Railway Station	Phondaghat, District Ratnagiri, Bombay ; 57 miles from Kolhapur Railway Sation
Whether research, multiplication or demonstration farm	Research farm

State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	164 inches Lat. 22.5° N Long. 51.00° E Alt. 400 feet
Soil type	Loams, derived from gniess and laterite
Programme of research	Breeding and agronomical work on paddy

29. Agricultural Research Station, Ratnagiri

Address and distance from Railway Station	Ratnagiri, Bombay ; 82 miles from Kolhapur Railway Station
When established	1953
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	105 inches Lat. 16.59° N Long. 73.18° E Alt. almost sea level
Soil type	Red loam
Programme of research	Breeding and agronomical research on paddy

30. Agricultural Research Station, Sholapur

Address and distance from Railway Station	Sholapur, Bombay ; 5 miles from Sholapur Railway Station
When established	1933
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	26 inches Lat. 17.40° N Long. 17.53° E Alt. 1563 feet
Soil type	Light and medium
Programme of research	Breeding research on *jowar*, groundnut, gram, *bajri*, etc.

31. Agricultural Research Station, Vadgaon

Address and distance from Station	Vadgaon, District Poona, Bombay ; 200 yards from Vadgaon Railway Station
When established	1940
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	51 inches Lat. 18.43° N Long. 73.41° E Alt. 1952 feet
Soil type	Trap-soil
Programme of research	Breeding and agronomical research on *jowar*, *Nagali*, sannhemp, grasses, pulses and paddy

32. Agricultural Research Station, Vijapur

Address and distance from Railway Station	Vijapur, District Mehsana, Bombay ; Vijapur Railway Station
When established	1944
Whether research, multiplication or demonstration farm	Research-*cum*-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	25 inches Lat. 24° N
Soil type	Sandy soils
Programme of research	Agronomic research on wheat, *bajri*, pulses and cotton

33. Agricultural College Farm, Poona

Address and distance from Railway Station	Poona, Bombay ; 2 miles from Poona Railway Station
When established	1907
Whether research, multiplication or demonstration farm	Research-*cum*-teaching institution

State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	26 inches Lat. 18.30° N Long. 73.50° E Alt. 1850 feet
Soil type	Varying from sandy loam to clayey loams
Programme of research	Breeding and agronomical research on cotton, maize, paddy, *bajri*, sugarcane, pulses, oilseeds, vegetables, etc.

34. Cotton Breeding Station, Viramgam

Address and distance from Railway Station	Viramgam, District Ahmedabad, Bombay ; 1½ miles from Viramgam Railway Station
When established	1922
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	23 inches Lat. 23° N Long. 72° E Alt. 90 feet
Soil type	Clayey, medium, black, saltish and varying much in depth.
Programme of research	Breeding research on cotton, *bajri*, *jowar*, wheat, etc.

35. Cotton Breeding Scheme, Hansot

Address and distance from Railway Station	Hansot, District Broach, Bombay ; 13 miles from Ankleswar Railway Station
When established	1937
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	30 to 35 inches Lat. 21.5° N Long. 71.5° E Alt. 1000 feet
Soil type	Heavy black cotton soil
Programme of research	Breeding research on cotton

36. Fruit Experimental Station, Gandevi

Address and distance from Railway Station	Gandevi, District Surat, Bombay ; 2 miles from Gandevi Railway Station
When established	1938
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	75 to 80 inches Lat. 20.47° N Long. 73° E Alt. 143 feet
Soil type	Medium black about 4 feet in depth
Programme of research	Agronomic research on fruits, *viz.* chiku, mango, citrus, guava, banana, pineapple and pomegranate

37. Ganeshkhind Fruit Experimental Station, Kirkee

Address and distance from Railway Station	Kirkee, District Poona, Bombay ; 1 mile from Kirkee Railway Station
When established	1921
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	25 to 30 inches Lat. 18.31° N Long. 73.51° E Alt. 1850 feet
Soil type	Medium black, about 3 in. to 4 in. only in depth

Programme of research	Agronomic research on vegetables and fruits, *viz.* mango, citrus, chiku, grape, guava, banana and pomegranate

38. Government Agricultural Farm, East Khandesh, Jalgaon

Address and distance from Railway Station	Jalgaon, East Khandesh, Bombay ; 2 miles from Jalgaon Railway Station
When established	1932.
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	25 to 30 inches Lat. 21.03° N Long. 75.34° E Alt. 660 feet
Soil type	Deep black
Programme of research	Breeding research on cotton and groundnut crops

39. Multiplication-*cum*-Demonstration Farm, Modibag

Address and distance from Railway Station	Modibag, District Poona, Bombay ; 3 miles from Poona Railway Station
When established	1920
Whether research, multiplication or demonstration farm	Multiplication-*cum*-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	25 inches Lat. 18.31° N Long. 73.51° E Alt. 1850 feet
Soil type	Medium black
Programme of research	Agronomic research on fruits, *viz.* pomegranate, citrus, mango, guava, fig, banana, papaya, chiku, grapes, etc.

40. Rice Breeding Station, Derol

Address and distance from Railway Station	Derol, District Panchmahals, Bombay ; Railway Station Derol
When established	1947
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	Lat. 22° N Long. 73° E Alt. 350 feet
Soil type	Sandy loam
Programme of research	Breeding and agronomic research on paddy

41. Rice Breeding Station, Navagam

Address and distance from Railway Station	Navagam, District Kaira, Bombay ; 11 miles from Barejadi Railway Station
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	30 inches Lat. 22.48° N Long. 72.38° E
Soil type	Deep black
Programme of research	Breeding and agronomic research on rice crop

42. Seed Multiplication Farm, Anand

Address and distance from Railway Station	Anand, District Kaira, Bombay ; 3 miles from Anand Railway Station
When established	1945
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	38 inches Lat. 22° N Long. 73° E Alt. 141 feet

Soil type	Deep alluvial soil, sandy loam
Programme of research	Breeding research on *bajri* and other cereals

43. Tobacco Research Station, Anand

Address and distance from Railway Station	Anand, District Kaira, Bombay ; 3 miles from Anand Railway Station
When established	1947
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	38 inches Lat. 22° N Long. 73° E Alt. 141 feet
Soil type	Deep alluvial soil, sandy loam
Programme of research	Breeding and agronomic research on tobacco

44. Agricultural Research Farm, Jamnagar

Address and distance from Railway Station	Jamnagar, District Halar, Bombay ; 4 miles from Jamnagar Railway Station
When established	1952
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	25 inches Lat. 22.28° N Long. 70.30° E Alt. 69 feet
Soil type	Clayey loam with medium black to brown colour
Programme of research	Research on all aspects of *bajra* and *jowar* (pure line selection of local types) is being carried out

45. Agricultural Research Station, Junagadh

Address and distance from Railway Station	Junagadh, District Sorath, Bombay ; 3 miles from Junagadh Railway Station
When established	1949
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	35 inches Lat. 20.30° N Long. 70.30° E Alt. 200 feet
Soil type	Loamy
Programme of research	To study the improved varieties evolved by neighbouring States and to find out their suitability with regard to high yield, early maturity and disease and insect resistance in the State and to evolve suitable *jowar* types with earliness, high yield and sweet stem

46. Groundnut Research Station, Junagadh

Address and distance from Railway Station	Junagadh, Bombay ; 4 miles from Junagadh Railway Station
When established	1951
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
Annual rainfall, latitude, longitude and altitude	34 inches Lat. 21.30° N Long. 70.30° E Alt. 190 feet
Soil type	Black clayey loam, shallow
Programme of research	Research on groundnut crop

47. Khapat Farm, Porbandar

Address and distance from Railway Station	Porbandar, Bombay; 4 miles from Porbandar Railway Station
When established	1946

Whether research, multiplication or demonstration farm	Seed multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	15 inches Lat. 21.39°N Long. 69.37°E Alt. 58 feet
Soil type	Sandy
Programme of research	Manurial, varietal and cultural trials on wheat, *jowar*, *bajara* and pulses

48. Sagdividi Farm, Junagadh

Address and distance from Railway Station	Junagadh, District Sorath, Bombay ; 5 miles from Junagadh Railway Station
When established	1951
Whether research, multiplication or demonstration farm	Multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	35 inches Lat. 20.30°N Long. 70.30°E Alt. 200 feet
Soil type	Loamy to clayey loam
Programme of research	Study and research on *jowar*, *bajra*, *moong*, cotton and maize crops

49. Agricultural Farm, Yeotmal

Address and distance from Railway Station	Yeotmal ; Vidarbha, Bombay State ; Railway Station Yeotmal
When established	1948
Whether research, multiplication or demonstration farm	Mainly multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	41 inches Lat. 20.24°N Long. 78.11°E Alt. 1481 feet
Soil type	Black cotton soil
Programme of research	Breeding research on cotton, *jowar* and groundnut

50. Agricultural Research Institute, Nagpur

Address and distance from Railway Station	Nagpur, Vidarbha, Bombay State ; about 2 miles from Nagpur Railway Station
When established	1905
Whether research, multiplication or demonstration farm	Research farm
State, Universiry or private managed	State managed
Programme of research	Investigation and research work on pulses, small millets, oilseeds, cereal crops, viz. maize, *rabi jowar*, barley ; sann-hemp and fodder crops, grasses and legumes, fibre crops and tobacco. Research on crop diseases due to fungi, bacteria and virus

51. Cotton Breeding Sub-Centre, Buldana

Address and distance from Railway Station	Government Farm, Buldana, Vidharbha, Bombay State ; 28 miles from Malkapur Railway Station
When established	1948
Whether research, multiplication or demonstration farm	Research farms
State, University or private managed	State managed
Programme of research	(i) Single plant selections from cultivators' fields and Government Farms (ii) Tests of improved strains (iii) Preliminary varietal trials of promising strains

(iv) Varietal trials of most promising varieties

(v) Multiplication of improved strains

The programme of work is followed in both *desi* and American cottons

52. Cotton Breeding Scheme, Nagpur

Address and distance from Railway Station	Nagpur, Vidharbha, Bombay State ; one mile from Nagpur Railway Station
When established	1948
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	45 inches Lat. 21.09°N Long. 79.07°E Alt. 1022 feet
Soil type	Black cotton soil
Programme of research	Breeding research on cotton, *jowar* and groundnut

53. Government Experimental Farm, Akola

Address and distance from Railway Station	Akola, Vidharabha, Bombay State ; 4 miles from Akola Railway Station
When established	1948
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication substation
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	33 inches Lat. 20.42°N Long. 77.02°E Alt. 925 feet
Soil type	Deep black cotton soil (clayey loam)
Programme of research	Breeding and agronomic research on cotton, *jowar*, *bajra* and groundnut

54. Government Experimental Farm, Nagpur

Address and distance from Railway Station	Nagpur, Vidharbha, Bombay State ; 1½ miles from Nagpur Railway Station
When established	1871-72
Whether research, multiplication or demonstration farm	Experimental farm
State, Universtity or private managed	State managed
Annual rainfall, latitude, longitude and altitude	45 inches Lat. 21.1°N Long. 79.1°E Alt. 1054 feet
Soil type	Heavy black cotton soil
Programme of research	Breeding and agronomic research on gram, wheat, groundnut, cotton, berseem, *jowar*, paddy and sugarcane

55. Government Experimental Farm, Tharsa

Address and distance from Railway Station	Tharsa, District Nagpur, Vidharbha, Bombay State ; 1 mile from Tharsa Railway Station
When established	1910
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	52 inches Lat. 21.15°N Long. 79.24°E Alt. 1020 feet
Soil type	Second class black (heavy) soil known as *morand* II.
Programme of research	Agronomic research on gram, linseed, wheat, *jowar*, and sugarcane

56. Government Seed and Demonstration Farm, Sindewahi

Address and distance from Railway Station	Sindewahi, District Chanda, Vidharbha, Bombay State ; 2 miles from Sindewahi Railway Station
When established	1912-13
Whether research, multiplication or demonstration farm	Demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	57 inches Alt. 723 feet
Soil type	Soil of about half of the area is sandy loam while the rest is black
Programme of research	Agronomic research on wheat, peas, pulses, gram, sugarcane and paddy

57. Nucleus Scheme, Nagpur

Address and distance from Railway Station	Nagpur, Vidharbha, Bombay State ; 1 mile from Nagpur Railway Station
When established	1948
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	45 inches Lat. 21.09°N Long. 79.07°E Alt. 1022 feet
Soil type	Black cotton soil
Programme of research	Breeding research on groundnut, cotton, *jowar* and *bajra*

58. Seed and Demonstration Farm, Buldana

Address and distance from Railway Station	Buldana, Vidharbha, Bombay State ; 28 miles from Malkapur Railway Station
Whether research, multiplication or demonstration farm	Multiplication-*cum*-demonstration farm
State. University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	35 inches Lat. 20.32°N Long. 76.14°E Alt. 2190 feet
Soil type	Black cotton soil with a substrata of *murum* 6 to 1 inches below.
Programme of research	Multiplication of groundnut, pulses cotton and *jowar* varieties

59. Seed and Demonstration Farm, Washim

Address and distance from Railway Station	Washim, District Akola, Vidharbha, Bombay State ; 52 miles from Akola Railway Station
When established	1918-1919
Whether research, multiplication or demonstration farm	Seed-*cum*-demonstration farm
State, Univerity or private managed	State managed
Annual rainfall, latitude, longitude and altitude	30 inches
Soil type	Half the soil is medium black, while the other half heavy black
Programme of research	Breeding and agronomic research on *jowar*, wheat, groundnut, cotton and miscellaneous crops

60. Seed and Demonstration Farm, Achalpur

Address and distance from Railway Station	Achalpur, District Amraoti, Vidharbha, Bombay State: 2 miles from Ellichpur Railway Station (Central Railway)
When established	1936
Whether research, multiplication or demonstration farm	Seed and multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	35 inches

	Lat. 21°N Long. 78°E
Soil type	The soil of the farm is black cotton soil ranging from light to medium type of soil
Programme of research	Varietal, manurial and cultural trials on *jowar*, cotton, *tur*, groundnut, soyabean and miscellaneous pulses

61. Agricultural Experimental Station, Parbhani

Address and distance from Railway Station	Parbhani, Marathawada, Bombay ; 1 furlong from Parbhani Railway Station
When established	1929
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	34 inches Lat. 19.16°N Long. 76.47°E Alt. 1340 feet
Soil type	Black cotton soil
Programme of research	Crop-weather observation study for crop growth, yield pests and diseases

62. Government Experimental Farm, Parbhani

Address and distance from Railway Station	Parbhani, Mahrathawada, Bombay State ; 1 furlong from Parbhani Railway Station
When established	1928
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	34 inches Lat. 19.16°N Long. 76.47°E Alt. 1340 feet
Soil type	Black cotton soil
Programme of research	Improved strains have been evolved of *kharif*-and *rabi-jowar*, and cotton, and work on other agricultural crops is also in progress

63. Crop Research Station, Badnapur

Address and distance from Railway Station	Badnapur, District Aurangabad, Marathawada, Bombay State ; 2 miles from Badnapur Railway Station
When established	1951
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	28 inches Lat. 70·30°N Long. 19·15°E
Soil type	Black cotton soil (light calcareous to heavy)
Programme of research	Evolving high yielding, rust resistant, drought resistant wheat strains in *Durum* and *Vulgare* types for different wheat tracts of Hyderabad State and production of higher ginning, wilt resistant and good yielding strains of modicum or verum type of cotton fit for 20's to 24's suited to Bhir District and the plains of Aurangabad District

64. Fruit Research Station, Aurangabad

Address and distance from Railway Station	Aurangabad, Marathawada, Bombay State ; 1 mile from Aurangabad Railway Station
When established	1935
Whether research, multiplication or demonstration farm	Research-*cum*-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	35 inches Lat. 20·N

	Long. 74·E Alt. 1900 feet
Soil type	Black, clayey, sandy loam
Programme of research	Research on citrus fruits, breeding high quality, high yielding and disease resistant variety of grapes

65. Plant Breeding Station, Latur

Address and distance from Railway Station	Latur, District Osmanabad, Marathawada, Bombay State ; 5 furlongs from Latur Railway Station
When established	1934
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	29 inches Alt. 2094 feet
Soil type	Medium heavy black soil
Programme of research	To evolve a good yielding, high ginning, early maturing and wilt resistant *Gaorani* cotton variety suitable for cultivation in the south-western part of the *Gaorani* protected area comprising Osmanabad, Sidaranad and Bihar Districts of State. In addition to the breeding work, various agronomic experiments on cotton crop are also conducted

66. Plant Breeding Station, Mudhol

Address and distance from Railway Station	Mudhol P.O., District Nanded, Marathawada, Bombay State ; 8 miles from Basar Railway Station
When established	1934
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	33 inches Lat. 18·59°N Long. 77·55°E Alt. 1118 feet
Soil type	Sandy loam
Programme of research.	The research programme consists of cotton breeding, agronomic experiments and propagation of improved varieties of cotton.

BOMBAY

ANIMAL HUSBANDRY RESEARCH STATIONS

1. Bombay Veterinary College, Bombay

Address and distance from Railway Station	Parel, Bombay ; about 6 furlongs from Parel Railway Station
When established	1891
Whether research, multiplication or demonstration farm	Experimental farm
State, University or private managed	State managed
Programme of research	Testing of animals with tuberculine isolation and typing of strains Agglutination test in brucellosis for isolation of strains and typing Complement fixation test for bovine surra To study the etiology of the Black Quarter Survey of incidence of mastitis, study of causal pathogenic organisms and treatment Survey of parasitic infection in animals in Bombay State To work out the life histories of some of the important parasites pathogenic to domestic animals To study the intermediate hosts and the insect vectors Investigation into coccidiosis of animals of this State has been worked out with reference to a number of species that are present in the State with a correct estimate of their relative pathogenicity

2. Cattle Breeding Station, Kopargaon

Address and distance from Railway Station	Kopargaon, District Ahmednagar, Bombay ; 2 miles from Kopargaon Railway Station
When established	1946
State, University or private managed	State managed
Programme of research	Study of the performance of Gir-breed pedigreed stock for breeding purpose

3. Disease Investigation Section, Poona

Address and distance from Railway Station	Poona, Bombay ; 4 miles from Poona Railway Station
When established	1932
State, University or private managed	State managed
Programme of research	At present, investigation into the following diseases of cattle and buffaloes of this State are being conducted : (i) diseases of unknown origin, (ii) bovine surra, (iii) nasal schistosomiasis (iv) brucellosis and (v) any other incidental investigation and urgent diagnostic work. The incidence of tuberculosis and brucellosis was studied and a number of experiments were conducted to investigate the possibility of immunising cattle against rinderpest

4. Poultry Breeding Station, Kirkee

Address and distance from Railway Station	Kirkee, District Poona, Bombay ; 1 miles from Kirkee Railway Station
When established	1936
State, University or private managed	State managed
Programme of research	(i) Grading of selected '*Desi*' hens with White Leghorn, Rhode Island Red and Barred Rock and Australop cocks upto six generations (ii) Trapnesting *Desi* hens of Mokhada, Nandurbar and Ankleswar strains and mating with respective *Desi* cocks for six generations to carry out hybridisation in the end (iii) Implantation of cocks with diethyl stilboestre to study its suitability to produce infertile eggs and the subsequent

reproductive ability of cocks
(iv) Other problems connected with poultry

5. Cattle Breeding Farm, Junagarh

Address and distance from Railway Station	Junagarh, Bombay ; 3 miles from Junagarh Railway Station
When established	1918
State, University or private managed	State managed
Programme of research	Breeding and rearing of Gir breed for regular calving and rearing of pedigree bulls and studying the effect of local feeds on milk yield of Gir cows

6. Central Veterinary Disease Investigation Laboratory, Nagpur

Address and distance from Railway Station	Nagpur, Bombay ; 1 mile from Nagpur Railway Station
When established	1932
State, University or private managed	State managed
Programme of research	Investigation of livestock diseases. Experimental work was done on goat virus vaccination with good results. The existence of brucellosis, coccidiosis, nasal granaloma and rhinosporodiosis was established for the first time in the State and suitable measures of control were evolved

7. Disease Investigation Station, Junagarh

Address and distance from Railway Station	Junagarh, Bombay State
When established	1955
State, University or private managed	Managed by the Central and State Governments
Programme of research	To carry out investigation into diseases of unknown origin of livestock including the following diseases: 1. Black Quarter 2. Tuberculosis 3. Johne's disease 4. Mastitis 5. Contagious caprine pleuro-pneumonia 6. Sheep pox 7. Enterotoxaemia, etc.

8. Baffalo Breeding Farm, Aurangabad

Address and distance from Railway Station	Aurangabad, Bombay ; 5 miles from Aurangabad Railway Station
When established	1951
State, University or private managed	State managed
Programme of research	Breeding and artificial insemination

9. Cattle Breeding and Stud Farm, Hingoli

Address and distance from Railway Station	Hingoli, Bombay ; 2 miles from Hingoli Railway Station
When established	1918
State, University or private managed	State managed
Programme of research	Breeding and artificial insemination and registration of Red Khandari cattle and improve them by selection and cross-breeding with Sindhi bulls.

HIMACHAL PRADESH

AGRICULTURAL RESEARCH STATIONS

1. Potato Development Station, Shilaroo

Address and distance from Railway Station	Shilaroo, Mahasu District, Himachal Pradesh ; 32 miles from Simla Railway Station
When established	1949.
Whether research, multiplication or demonstration farm	Research-*cum*-seed multiplication-*cum*-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude, altitude	70 inches Lat. 81.12°N Long. 77.27°E Alt. 8,500 feet
Soil type	Loam to clay loam
Programme of research	To conduct varietal and agronomic experiments on potato and to produce disease-free, nucleus seed stock of potato

2. Potato Development Substation, Khadrala

Address and distance from Railway Station	Khadrala, Mahasu District, Himachal Pradesh ; 56 miles from Simla Railway Station
When established	1955
Whether research, multiplication or demonstration farm	Seed multiplication-*cum*-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	80 inches Alt. 9,500 feet
Soil type	Loam to clay loam
Programme of research	Multiplication of disease-free nucleus and foundation seed of potato

3. Agricultural Farm, Parala

Address and distance from Railway Station	Parala, Mahasu District, Himachal Pradesh ; 28 miles from Simla Railway Station
When established	1948
Whether research, multiplication or demonstration farm	Seed multiplication farm-*cum*-fruit nursery
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	50 inches Alt. 4,500 feet approximately
Soil type	Sandy loam intermingled with stones
Programme of research	Multiplication of improved seeds of cereals ; raising of nursery plants of pome and stone fruits. Research work on the improvement of vegetables is also located here for the time being

4. Agricultural Farm, Suni

Address and distance from Railway Station	Suni, Mahasu District, Himachal Pradesh ; 32 miles from Simla Railway Station
When established	1955
Whether research, multiplication or demonstration farm	Seed multiplication-*cum*, demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude, altitude	30 inches Alt. 1,800 feet
Soil type	Sandy
Programme of research	Multiplication of improved seed of cereals and arranging varietial and agronomic trials

5. Tehsil Agricultural Farm, Dattanagar

Address and distance from Railway Station	Dattanagar, Mahasu District, **Himachal Pradesh** 80 miles from Simla Railway Station
When established	1956

Whether research, multiplication or demonstration farm	Seed multiplication-*cum*-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	30-40 inches Lat. 31°N Long. 77.2°E Alt. 3,500 feet
Soil type	Clay loam to sandy loam
Programme of research	Multiplication of improved seed of cereals and arranging varietal and agronomic trials

6. Tehsil Agricultural Farm, Rohru

Address and distance from Railway Station	Gangtolibasa, Tehsil Rohru, Mahasu District ; 73 miles from Simla Railway Station
When established	1956
Whether research, multiplication or demonstration farm	Seed multiplication-*cum*-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	50 inches Alt. 5,000 feet
Soil type	Sandy loam
Programme of research	Multiplication of improved seed of cereals and arranging of varietal and agronomic trials

7. Tehsil Agricultural Farm, Annu

Address and distance from Railway Station	Village Annu, Tehsil Jubbal, Mahasu District, H.P., 62 miles from Simla Railway Station
When established	1956
Whether research, multiplication or demonstration farm	Seed multiplication-*cum*-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	50 inches Alt. 5,800 feet
Soil type	Clay loam
Programme of research	Multiplication of improved seed of cereals and arranging of varietal and agronomic trials

8. Potato Development Substation, Nihri

Address and distance from Railway Station	Nihri, Mandi District ; 200 miles rom Pathankot
When established	1953
Whether research, multiplication or demonstration farm	Multiplication-*cum*-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	70 inches Alt. 7,500 ft.
Soil type	Clay loam
Programme of research	Multiplication of disease-free nucleus seed of potato

9. Agricultural Farm, Jogindernagar

Address and distance from Railway Station	Jogindernagar, Mandi District ; It is the last terminus of Kangra Valley Railway
When established	1951
Whether research, multiplication or demonstration farm	Research-*cum*-demonstration-*cum*-seed multiplication farm
Programme of research	Arranging of varietal and agronomic experiments on various crops, mainly rice and maize; multiplication of seed of improved varieties of cereals

10. Agricultural Farm, Bhangrotu

Address and distance from Railway Station	Bhangrotu, Mandi District ; 41 miles from Jogindernagar Railway Station
When established	1949
Whether research, multiplication or demonstration arm	Research-*cum*-seed multiplication-*cum*-demonstration farm
State, University or private managed	State managed

Annual rainfall, latitude, longitude and altitude	60 inches Alt. 2,500 feet
Soil type	Clay loam to loam
Programme of research	Arranging varietal and agronomic experiments on wheat, rice, maize, sugarcane, etc. and multiplication of seeds of improved varieties

11. Potato Development Station, Ahla

Address and distance from Railway Station	Ahla, Chamba District ; 52 miles from Pathankot Railway Station
When established	1950
Whether research, multiplication or demonstration farm	Seed Multiplication-*cum*-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	90 inches Alt. 7,500 feet
Soil type	loamy
Programme of research	Arranging varietal and agronomic trials on potato; raising of disease-free nucleus seed stock of approved varieties of potato

12. Agricultural Farm, Bhanota

Address and distance from Railway Station	Bhanota, District Chamba ; 67 miles from Pathankot Railway Station
When established	1949
Whether research, multiplication or demonstration farm	Seed multiplication-*cum*-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	40 inches Alt. 3,000 feet
Soil type	Loam
Programme of research	Arranging varietal and agronomic trials on wheat, rice, maize and other crops; multiplication of seed of improved varieties

13. Agricultural Farm, Rajpura

Address and distance from Railway Station	Rajpura, Chamba District ; 84 miles from Pathankot Railway Station
When established	1956
Whether research, multiplication or demonstration farm	Seed multiplication-*cum*-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	40 inches Alt. 3,000 feet
Soil type	Sandy loam
Programme of research	Arranging varietal and agronomic trials on cereals; multiplication of seeds of improved varieties; demonstration in contour bunding

14. Potato Development Station, Kwagdhar

Address and distance from Railway Station	Kwagdhar, Sirmur District ; 64 miles from Ambala
When established	1953
Whether research, multiplication or demonstration farm	Seed multiplication-*cum*-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	50 inches Alt. 7,500 feet
Soil type	Clay loam
Programme of research	Multiplication of disease-free nucleus seed stock of approved varieties of potato; arranging varietal and agronomic trials on potato

15. Potato Development Substation, Kheradhar

Address and distance from Railway Station	Kheradhar, Sirmoor District ; 29 miles from Solan Railway Station
When established	1955
Whether research, multiplication or demonstration farm	Multiplication-*cum*-demonstration farm

State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	70 inches ; Alt. 7,000 feet
Soil type	Clay loam
Programme of research	Multiplication of disease-free seed stock of approved varieties of potato

16. Agricultural Farm, Bagthan

Address and distance from Railway Station	Bagthan, Tehsil Pachhad, Sirmur District, 48 miles from Solan Railway Station
When established	1956
Whether research, multiplication or demonstration farm	Research-*cum*-seed multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	50/60 inches, Long. 77.65° E Lat. 30.40°N Alt. 3,500 feet
Soil type	Heavy loam
Programme of research	Arranging varietal and agronomic trials on cereals and multiplication of seed of improved varieties

17. Agricultural Farm, Bubi

Address and distance from Railway Station	Village Bubi, P.O. Dadahu, Sirmur District ; 62 miles from Railway Station Solan
When established	1956
Whether research, multiplication or demonstration farm	Research-*cum*-seed multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	50-60 inches Lat. 30.35° N Long. 77.89° E Alt. 2,000 feet
Soil type	Light loam
Programme of research	Arranging varietal and agronomic trials on cereals and multiplication of seed of improved varieties

18. Agricultural Research Station, Dhaula-Kuan

Address and distance from Railway Station	Dhaula-Kuan, Sirmur District; 76 miles from Ambala Cantt. and 45 miles from Jagadhari
When established	1949
Whether research, multiplication or demonstration farm	Research-*cum*-seed multiplication-*cum*-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	60 inches Alt. 1,500 feet
Soil type	Sandy loam
Programme of research	Evolution of improved varieties of various crops (wheat, maize, barley, sugarcane, etc.) ; determination of optimum cultural and manurial requirements of different crops; and multiplication of seed of improved varieties; progeny orchard for sub-tropical fruits,

19. Agricultural Farm, Auhr

Address and distance from Railway Station	Auhr, Bilaspur District, 54 miles from Rupar Railway Station
When established	1947
Whether research, multiplication or demonstration farm	Seed multiplication-*cum*-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	45 inches Lat. 31.23°N Long, 76.44°E Alt. 1,710 feet

Soil type	Sandy loam
Programme of research	Arranging varietal and agronomic trials; multiplication of seed of improved varieties

20. Horticultural Research Station, Mashobra

Address and distance from Railway Station	Mashobra, Mahasu District 8 miles from Simla Railway Station
When established	1953
Whether research, multiplication or demonstration farm	Research station for temperate fruits
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	About 60 inches Alt. 7,500 feet
Soil type	Clayey loam intermingled with stones
Programme of research	Research on various aspects (varietal cultural, manurial, etc.) of temperate fruits (apple, pear, cherry, plum, peach, apricot, etc.)

21. Horticultural Research Substation, Chini

Address and distance from Railway Station	Chini, Mahasu District 140 miles from Simla Railway Station
When established	1953
Whether research, multiplication or demonstration farm	Research station for dry fruits
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	About 20 inches Alt. 9,000 feet
Soil type	Clayey loam intermingled with stones
Programme of research	Research on various aspects of dry fruits (raisin grapes, almonds, walnut).

HIMACHAL PRADESH

ANIMAL HUSBANDRY RESEARCH STATIONS

1. Sheep Breeding Research Station, Sarahan

Address and distance from Railway Station	Sarahan, District Mahasu ; 113 miles from Simla Railway Station
When established	1955
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	40 inches Lat. 32.31° N Long. 77.47° E Alt. 5,000 feet (approx.)
Programme of research	Selective breeding of the indigenous strain and cross breeding of the indigenous sheep with pedigree Rambouillet rams and evolve a new breed of sheep suitable to the local environments.

JAMMU AND KASHMIR

AGRICULTURAL RESEARCH STATIONS

1. Provincial Experimental Farm, Shalamar

Address and distance from Railway Station	Shalamar, Tehsil Srinagar, District Srinagar, Jammu and Kashmir State; 281 miles from Pathankot Railway Station
When established	1910 as Partap Model Farm ; 1952 as Provincial Experimental Farm
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	25 inches Lat. 34·10° N Long. 75·00° E Alt. 5200 feet
Soil type	Loam soil
Programme of research	Manurial, cultural and breeding experiments on paddy, wheat, maize, vegetables, pulses and deciduous fruits

2. Paddy Experimental Farm, Khudwani

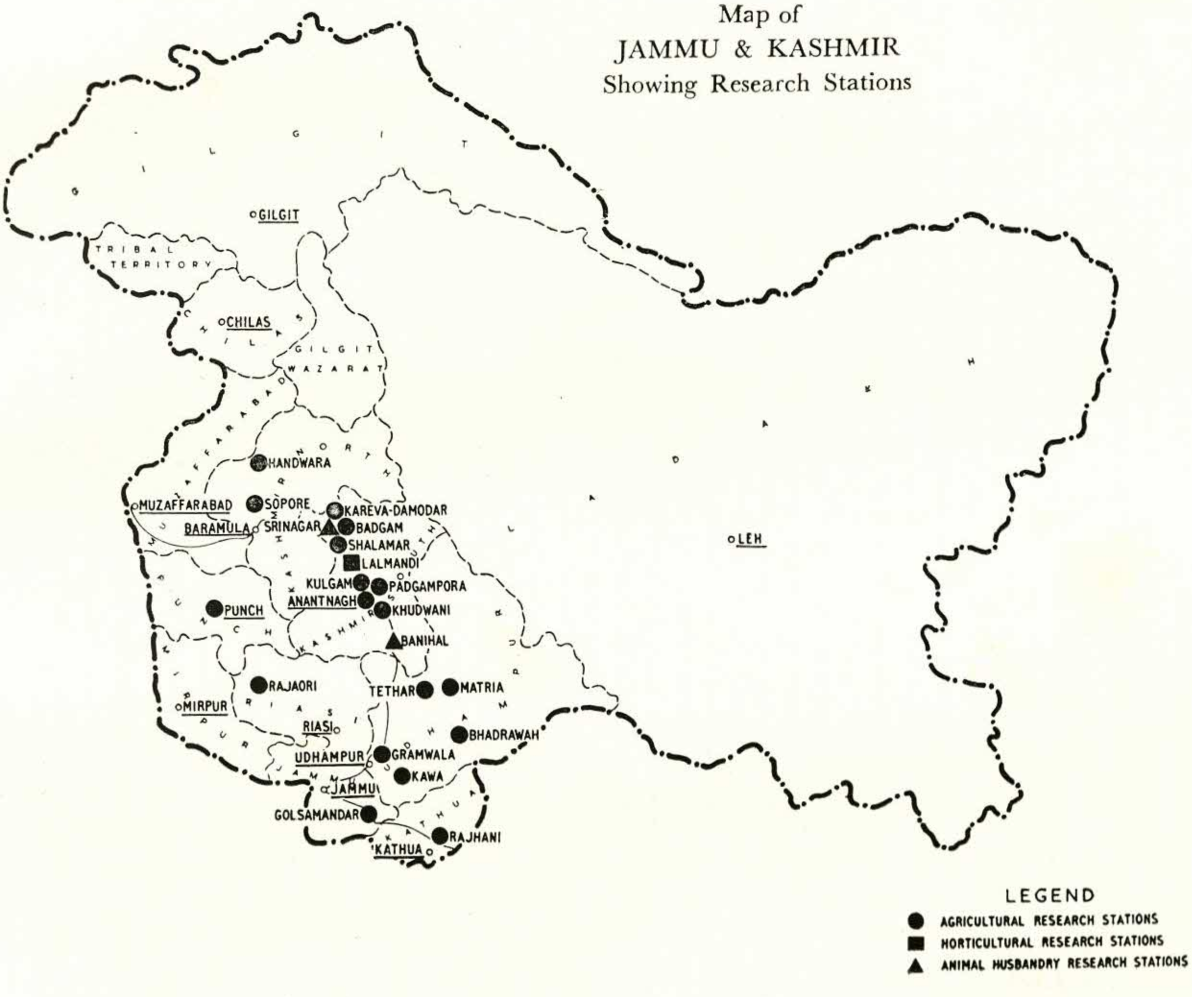
Address and distance from Railway Station	Khudwani, Tehsil Kulgam, District Anantnag, Jammu and Kashmir State; 238 miles from Pathankot Railway Station
When established	1941
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	25 inches Lat. 33·48°N Long. 75·2° E Alt. 5299 feet
Soil type	Clayey loam
Programme of research	Manurial, cultural and breeding experiments on paddy; hybrid maize experiments

3. Wheat Multiplication Farm, Kareva-Damodar

Address and distance from Railway Station	Kareva-Damodar, Tehsil Budgam, District Srinagar, Jammu and Kashmir State; 285 miles from Pathankot Railway Station
When established	1956
Whether research, multiplication or demonstration farm	Multiplication-*cum*-research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	25 inches Lat. 33·50° N Long. 74·50° E Alt. 5400 feet
Soil type	Clayey loam
Programme of research	Manurial and varietal experiments on wheat

4. Paddy and Maize Multiplication Farm, Padgampora

Address and distance from Railway Station	Padgampora, Tehsil Pulwama, District Anantnag, Jammu and Kashmir State, 256 miles from Pathankot Railway Station
When established	1954
Whether research, multiplication or demonstration farm	Multiplication-*cum*-research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	25 inches Lat. 33.50° N Long. 75·00°E Alt. 5200 feet
Soil type	Loamy soil
Programme of research	Hybrid maize experiments; selection of paddy (China 1039) resistant to shattering



Map of
JAMMU & KASHMIR
Showing Research Stations

5. Tehsil Farm, Sopore

Address and distance drom Railway Station	Sopore, Tehsil Sopore, District Baramulla, Jammu and Kashmir State; 300 miles from Pathankot Railway Station
When established	1954
Whether research, multiplication or demonstration farm	Demonstration-*cum*-research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	25 inches Lat. 34·15° N Long. 74·30° E Alt. 5200 feet
Soil type	Loamy
Programme of research	Manurial and varietal experiments on various crops

6. Tehsil Farm, Handwara

Address and distance from Railway Station	Maidan Chogal, Tehsil Handwara, District Baramulla, Jammu and Kashmir State; 314 miles from Pathankot Railway Station
When established	1954
Whether research, multiplication or demonstration farm	Demonstration-*cum*-research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	25 inches Lat. 34·25° N Long. 74·20° E Alt. 5200 feet
Soil type	Loamy
Programme of research	Manurial and varietal trial experiments on various crops

7. Tehsil Farm, Badgam

Address and distance from Railway Station	Harran, Tehsil Badgam, District Srinagar, Jammu and Kashmir State; 281 miles from Pathankot Railway Station
When established	1954
Whether research, multiplication or demonstration farm	Demonstration-*cum*-research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	25 inches Lat. 34·0° N Long. 74·55° E Alt. 5290 feet
Soil type	Loamy soil
Programme of research	Manurial and varietal trial experiments on various crops

8. Tehsil farm, Anantnagh

Address and distance from Railway Station	Dealgam, Tehsil Anantnagh, District Anantnagh, Jammu and Kashmir State; 240 miles from Pathankot Railway Station
When established	1954
Whether research, multiplicaion or demonstration farm	Demonstration-*cum*-research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	25 inches Lat. 33·25° N Long. 75·15° E Alt. 5200 feet
Soil type	Loamy soil
Programme of research	Manurial and varietal trial experiments on various crops

9. Tehsil farm, Kulgam

Address and distance from Railway Station	Pamba-Kakran, Tehsil Kulgam, District Anantnagh, Jammu and Kashmir State ; 244 miles from Pathankot Railway Station
When established	1956
Whether research multiplication or demonstration farm	Demonstration-*cum*-research farm
State, University or private managed	State managed

Annual rainfall, latitude, longitude and altitude	25 inches Lat. 33·40°N Long. 75·1°E Alt. 5300 feet
Soil type	Loamy soil
Programme of research	Manurial and varietal experiments on various crops

10. Flower breeding Station, Lalmandi

Address and distance from Railway Station	Lalmandi, Tehsil Srinagar, District Srinagar, Jammu and Kashmir State; 272 miles from Pathankot Railway Station
When established	1933 as Flower Nursery 1952 as Flower Breeding Station
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication-*cum*-demonstration station
State, University or private managed	State managed
Annual rainfall, latitude longitude and altitude	25 inches Lat. 34·5°N Long. 74·45°E Alt. 5200 feet
Soil type	Clayey loam
Programme of research	Cultural and breeding experiments on flowers

11. Provincial Experimental Farm, Golsamandar

Address and distance from Railway Station	Golsamandar, Tehsil Jammu, District Jammu, Jammu and Kashmir State; 72 miles from Pathankot Railway Station
When established	1930 as Golsamandar farm· 1952 Provincial Experimental Farm, Golsamandar
Whether research multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	42 inches Lat. 32·54°N Long. 74·51°E Alt. 1020 feet
Soil type	Loamy soil
Programme of research	Varietal and manurial experiments on wheat, barley, gram sugarcane and vegetables

12. Tehsil farm, Reasi (Gramwala)

Address and distance from Railway Station	Gramwala, Tehsil Reasi, District Udhampur, Jammu and Kashmir State; 120 miles from Pathankot Railway Station
When established	1952
Whether research, multiplication or demonstration farm	Demonstration-*cum*-research farm
State, University or private managed	State managed.
Annual rainfall, latitude longitude and altitude	32 inches Lat. 33·5°N Long. 74·50°E Alt. 1920 feet
Soil type	Sandy loam
Programme of research	Varietal and cultural experiments on wheat and maize

13. Tehsil Farm Kawa, Udhampur

Address and, distance from Railway Station	Kawa, Tehsil Udhampur, District Udhampur, Jammu and Kashmir State; 114 miles from Pathankot Railway Station
When established	1952
Whether research, multiplication or demonstration farm	Demonstration-*cum*-research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	32 inches Lat. 32·55°N Long. 75·8°E Alt. 2248 feet
Soil type	Sandy loam

Programme of research	Varietal and cultural experiments on paddy, wheat, maize and fodder crops

Tehsil Farm, Kathua (Rajhani)

Address and distance from Railway Station	Rajhani, Tehsil Kathua, District Kathua, Jammu and Kashmir State; 15 miles from Pathankot Railway Station
When established	1952
Whether research, multiplication or demonstration farm	Demonstration-*cum*-research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	40 inches Lat. 32·22°N Long. 75·32°E Alt. 1051 feet
Soil type	Sandy loam
Programme of research	Varietal and cultural experiments on paddy, wheat, gram, barley and fodder

15. Tehsil Farm, Ramban (a—Matria-Ramban (b—Tethar-Banihal,

Address and distance from Railway Station	(a) Matria—Ramban, Tehsil Ramban, District Doda, Jammu Kashmir State; 161 miles from Pathankot Railway and Station (b) Tethar—Banihal, Tehsil Ramban, District Doda, Jammu and Kashmir State; 128 miles from Pathankot Railway Station
When established	1952
Whether research, multiplication or demonstration farm	Demonstration-*cum*-research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	33 inches Lat. (Matria—33.15 ; Tethar—33.28 °N Long. 75.15°E Alt. (Matria—2140 ; Tethar—5600 feet)
Soil type	Matria—Sandy loam Tethar—Clayey loam
Programme of research	Varietial and cultural experiments on paddy and wheat

16. Tehsil Farm, Bhadrawah

Address and distance from Railway Station	Bhadrawah, Tehsil Bhadrawah, District Doda, Jammu and Kashmir State
When established	1952
Whether research, multiplication or demonstration farm	Demonstration-*cum*-research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	25 inches Lat. 33.0.N Long. 75.45°E Alt. 5540 feet
Soil type	Clayey loam
Programme of research	Varietal and cultural experiments on wheat, maize and other crops

17. Tehsil Farm, Rajaori

Address and distance from Railway Station	Rajaori, Tehsil Rajaori, District Punch, Jammu and Kashmir State ; 170 miles from Pathankot Railway Station
When established	1955-56
Whether research, multiplication or demonstration farm	Demonstration-*cum*-research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	35 inches Lat. 33.25°N Long. 74.20°E Alt. 3200 feet

Soil type	Sandy loam
Programme of research	Varietal and cultural experiments on various crops

18. Tehsil Farm, Punch

Address and distance from Railway Station	Punch, Tehsil Punch, District Punch, Jammu and Kashmir State ; 227 miles from Pathankot Railway Station
When established	1954-55
Whether research, multiplication or demonstration farm	Demonstration-*cum*, research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	33 inches Lat. 33.42°N Long. 74.4°E Alt. 3210 feet
Soil type	Clayey loam
Programme of research	Varietal and cultural experiments on various crops.

JAMMU AND KASHMIR

ANIMAL HUSBANDRY RESEARCH STATIONS

1. Government Sheep Breeding and Research Farm, Banihal

Address and distance from Railway Station	Banihal, Jammu and Kashmir, 185 miles from Pathankot Railway Station and Reasi, Jammu and Kashmir, 113 miles from Pathankot Railway Station
When established	1938
State, University or private managed	State managed
Programme of research	The main object of the scheme is to evolve suitable types of sheep for different areas of the State, yielding wool superior in quality and quantity by cross-breeding local ewes with Rambouillet rams imported from America

2. Veterinary Disease Investigation Section, Srinagar

Address and distance from Railway Station	Srinagar, Jammu and Kashmir, one mile from Srinagar Railway Out-Agency
When established	1944
State, University or private managed	State managed
Programme of research	Disease control. Technical programme includes: Fascioloasis—treatment and control; dicrocoeliasis in sheep and goats, lung worm disease in sheep and goats, linguatula serrata survey of tuberculosis in cattle and birds ; contagious abortion in sheep and cattle ; investigation to evolve suitable control measures for contagious diseases of demesticated animals ; manufacture of some biological products for control of above mentioned diseases.

KERALA

AGRICULTURAL RESEARCH STATIONS

1. Agricultural Research Station, Ambalavayal

Address and distance from Railway Station	Ambalavayal, District Cannanore, Kerala ; 62 miles from Calicut Railway Station
When established	1945
Whether research, multiplication or demonstration farm	Research and multiplication-*cum*-demonstration farm
State, University or privte managed	State managed
Annual rainfall, latitude, longitude and altitude	85 inches Lat. 11.37°N Long. 76.12°E Alt. 3200 feet
Soil type	Red loam
Programme of research	Agronomic research on paddy, sugarcane, tapioca, ginger, yam, bananas, mandarin oranges, pineapple, lemon, pepper, cardamom, coffee, cocoa, kolanut and cinnamon

2. Agricultural Research Station II, Nileshwar

Address and distance from Railway Station	Nileshwar, District Cannanore, Kerala; one mile from Nileshwar Railway Station
When established	1916
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	146 inches Lat. 11.15°N Long. 75.10°E Alt. 10 feet
Soil type	Red sandy loam
Programme of research	Research to produce high yielding palm with desirable economic characters ; control of pests

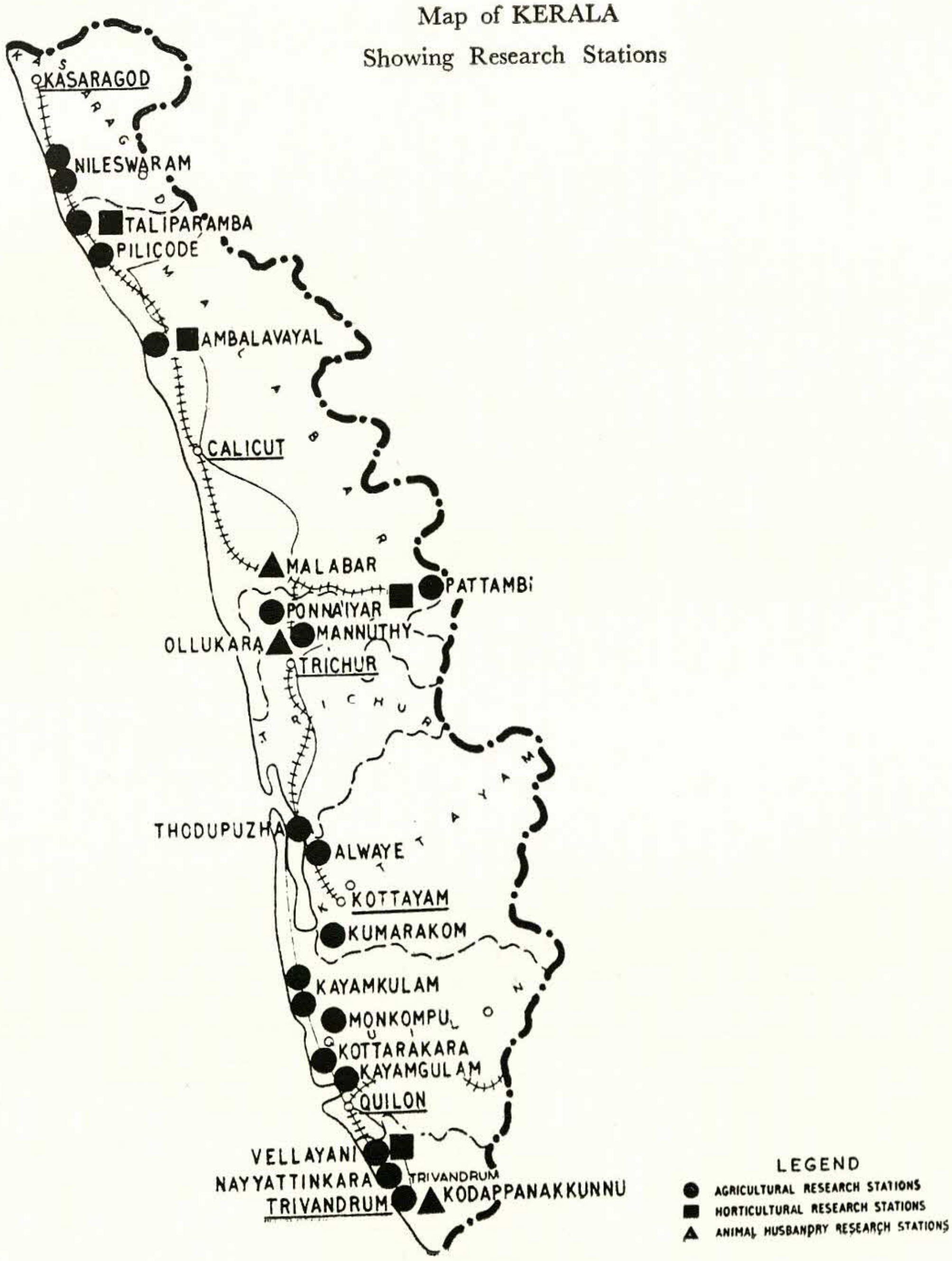
3. Agricultural Research Station III, Nileshwar

Address and distance from Railway Station	Nileshwar, District Cannanore, Kerala ; 2 miles from Nileshwar Railway Station
When established	1916
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	148 inches Lat. 11°N Long. 75°E Alt. The station is almost on the sea level
Soil type	Coarse, barren, sandy
Programme of research	Evolving new varieties of coconut and research on pest control ; investigation into the cultural and manurial requirements of coconut

4. Agricultural Research Station, Pilicode

Address and distance from Railway Station	Pilicode, District Cannanore, Kerala ; 1 miles from Charvathur Railway Station
When established	1916
Whether research, multiplication or demonstration farm	Research station
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	139 inches Lat. 13°N Long. 75°E Alt. about 50 feet
Soil type	Gravelly laterite soil

Map of KERALA
Showing Research Stations



Programme of research	Investigation into the cultural and manurial aspects of coconut cultivation, study of exotic varieties and breeding of coconut to evolve economic types

5. Agricultural Research Station, Taliparamba

Address and distance from Railway Station	Taliparamba, District Cannanore, Kerala ; 11 miles from Pappinisseri Railway Station
When established	1905
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication-*cum*-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	144 inches Lat. 12.2°N Long. 74.50°E Alt. 150 feet
Soil type	Red gravelly loam
Programme of research	Manurial and varietal trials on paddy, arecanut, coconut, tapioca, sapota, pepper, chilli, pineapple, cashewnut and mangoes

6. Pepper Research Station, Panniyur

Address and distance from Railway Station	Panniyur, District Cannanore, Kerala; 13 miles from Pappinisserri Railway Station
When established	1952
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	145 inches Lat. 12.5°N Long. 74.55°E Alt. 300 feet
Soil type	Gravelly loam with high humus content
Programme of research	Manurial and varietal trials on pepper vines

7. Agricultural Research Station, Pattambi

Address and distance from Railway Station	Pattambi, Palghat District, Kerala ; 1 mile from Pattambi Railway Station
When established	1927
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	102 inches Lat. 10.48°N Long. 76.12°E Alt. 83.20 ft.
Soil type	Laterite loam
Programme of research	Varietal, cultural and manurial trials on pineapple, paddy, colocasia, yam, ginger, sweet potato, tapioca, banana, gingely and cotton

8. Paddy Breeding Station, Kayangulam

Address and distance from Railway Station	Kayangulam, Quilon District, Kerala ; 26 miles from Quilon Railway Station
When established	1939.
Whether research, multiplication or demonstration farm	Seed-*cum*-multiplication Station
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	120 inches Lat. 9.8°N Long. 76.31°E Alt. 10 feet above sea level
Soil type	Sandy loam
Programme of research	Breeding better varieties suitable for the area, conducting

experiments on agronomical problems connected with the paddy crop

9. Paddy Improvement Station, Kayamkulam

Address and distance from Railway Station	Kayamkulam, Quilon District, Kerala; 26 miles from Quilon Railway Station
When established	1955
Whether research, multiplication or demonstration farm	Multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	120 inches Lat. 9.8° N Long. 76.31° E Alt. 10 feet above sea level
Soil type	Sandy loam
Programme of research	Multiplication and distribution of U.R. 19 seed ; paddy-experiments with other varieties are also undertaken

10. Regional Cashewnut Research Station, Kottarakara

Address and distance from Railway Station	Kottarakara, Quilon District, Kerala; 2½ miles from Kottarakara Railway Station
When established	1952
Whether research, multiplication or demonstration farm	Mainly research, multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	60 to 70 inches Lat. 90° N Long. 77° E
Soil type	Semi gravelly
Programme of research	Survey and collection of types, evolving suitable nursery technique, multiplication by air layering, testing of selected clonal progenies, blossom biological studies and manurial-*cum*-spacing experiments

11. Paddy Breeding Station, Monkompu

Address and distance from Railway Station	Monkompu, Quilon District, Kerala; 50 miles from Ernakulam Railway Station
When established	1940
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	115 to 120 inches Lat. 9.5° N Long. 76.5° E Alt. 6 feet above sea level
Soil type	Clayey soil rich in acid
Programme of research	Survey and collection of different types of paddy with special reference to acid and saline resistance; varietal and cultural experiments of exotic and indigenous strains; evolution of new strains on the basis of yield, duration, acid and saline resistance; inter-varietal test trials; agronomic trials like determination of the optimum age of seedlings, determination of the optimum seed rate for sowing in each standard variety, transplanting vs. sowing, single plant selection from *japonica indica* cross combinations, breeding of salt and flood resistant varieties of paddy

12. Agricultural College Research Institute, Vellayani

Address and distance from Railway Station	Agricultural College and Research Institute, Vellayani, Trivandrum District; Kerala; 8 miles from Trivandrum Railway Station
When established	1955
Whether research, multiplication or demonstration farm	Research farm

State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	60 inches Lat. 8° N Long. 77° E Alt. 98 feet above sea level
Soil type	Red loam (laterite)
Programme of research	Soil surveys, soil testing, microbiology of peat soils, studies on organic matter, studies on legume bacteria, studies on laterite soils, model agronomic experiments, investigations on rice stem borers, investigation on the control of the rice-bug, collection and study of insect pests affecting crops in the college farm, investigation of the bunchy top disease of bananas, investigation of the disease of cardamom, observations on the blast and blight disease of rice

13. Tapioca Research Station, Trivandrum

Address and distance from Railway Station	Trivandrum, Kerala; 3 miles from Trivandrum Railway Station
When established	1945
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	67 inches Lat. 8.30° N Long. 76.59° E Alt. 175 feet above sea level
Soil type	Laterite
Programme of research	Collection and classification of available varieties of tapioca and sweet potato, cytological studies, breeding work, experiments on cultural and manurial practices, anatomical studies, chemical analysis, etc.

14. Paddy Farm, Alwaye

Address and distance from Railway Station	Alwaye, Trichur District, Kerala; 6 furlongs from Alwaye Railway Station
Whether research, multiplication or demonstration farm	Multiplication farm
State, University or private managed	State managed
Annual rainfall	95 inches
Soil type	Clayey loam and sandy loam

15. Arecanut Research Station, Mannuthy

Address and distance from Railway Station	Mannuthy, Trichur District, Kerala State; 5 miles from Trichur Railway Station
When established	1952
Whether research, multiplication or demonstration farm	Research
State, University or private managed	State managed
Soil type	Red loam
Programme of research	Experiments on transplanted seedlings, on the study of germination, on inter-cropping, on the study of the effect of organic *cum* inorganic manures, on methods of planting and harvesting.

KERALA

ANIMAL HUSBANDRY RESEARCH STATIONS

1. Livestock Farm, Ollukara

Address and distance from Railway Station	Livestock Farm, Ollukara, Mannuthy P.O.; Five miles from Trichur Railway Station
When established	In 1918. Transferred to this Department in the year 1950 from the Agriculture Department
State, University or private managed	State owned
Programme of work	Cattle breeding, dairying, and cultivation of fodder crops

2. Dairy Farm, Kodappanakkunnu

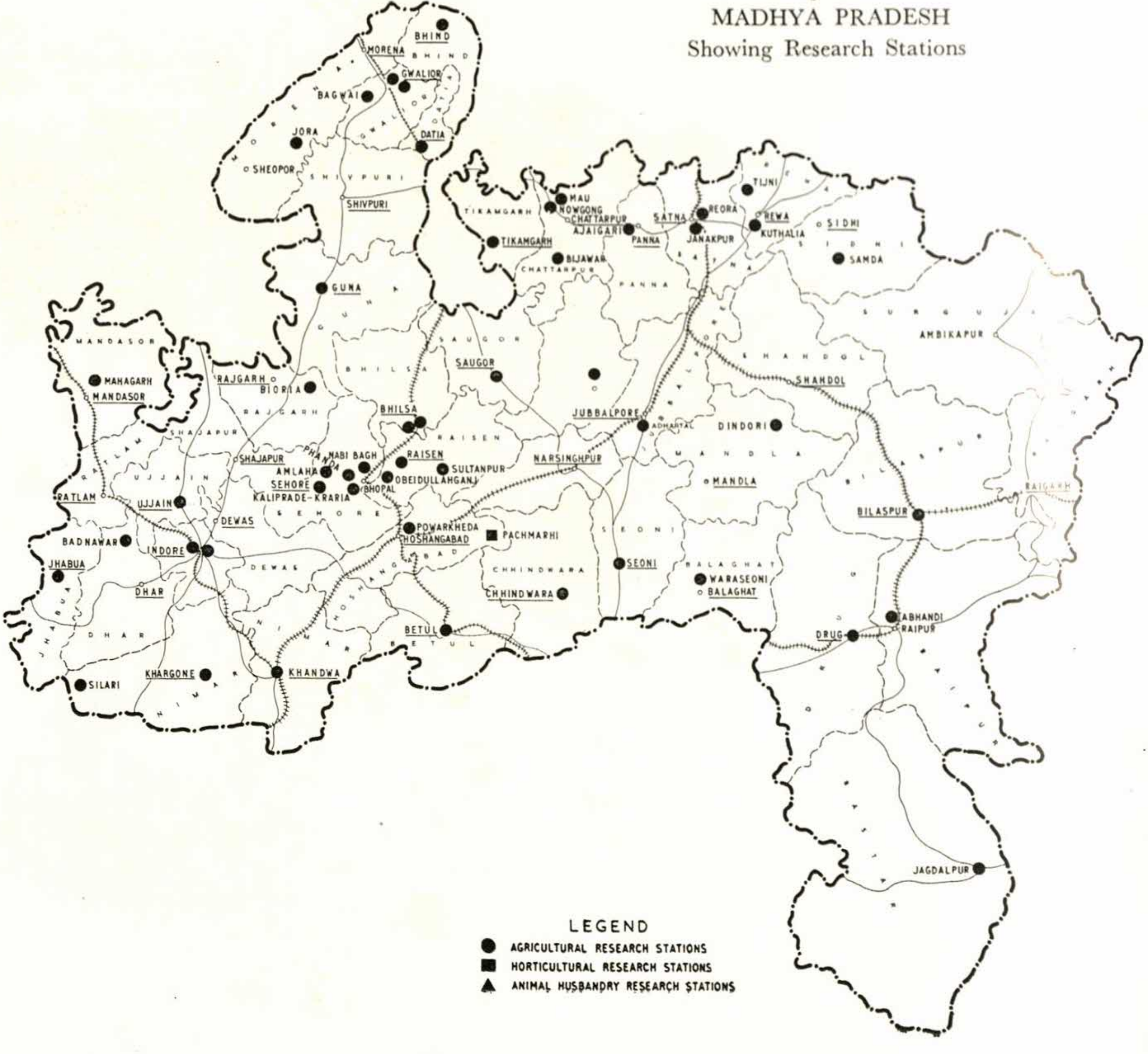
Address and distance from Railway Station	Cattle-*cum*-Breeding Farm, Kodappanakkunnu, Trivandrum-5, Kerala State; 6 miles from Trivandrum Railway Station.
When established	1953
State, University or private managed	State owned
Programme of sork	Breeding of Sindhi and Murrah breeds of cattle, dairying and cultivation of fodder crops

3. District Livestock Farm, Malabar

Address and distance from Railway Station	District Livestock Farm, Thiruvazhumkunnu, Palghat District, Kerala State; 28 miles from Olavakode Railway Station
When established	1950'
State, University or private managed	State managed
Programme of research	(i) Analysis of grasses, other fodders and present indigenous feeds given to cattle (ii) Nutrition experiments with best combination of feeds (iii) Experimental breeding programme for finding out the best Indian breed suitable for the area.

PLATE LXXII]

Map of
MADHYA PRADESH
Showing Research Stations



MADHYA PRADESH

AGRICULTURAL RESEARCH STATIONS

1. Government Experimental Farm, Adhartal

Address and distance from Railway Station	Adhartal, District Jabalpur, Madhya Pradesh ; 4 miles from Jabalpur Railway Station
When established	1912
Whether research, seed multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude longitude and altitude	56 inches Lat. 23.9° N Long. 79.58° E Alt. 1351 feet
Soil type	Light-sandy, sandy loam and clayey loam heavy
Programme of research	Agronomic research on gram, wheat, paddy, sugarcane, linseed peas and miscellaneous crops

2. Government Experimental Farm, Labhandi

Address and distance from Railway Station	Labhandi, District Raipur, Madhya Pradesh, 6 miles from Raipur Railway Station
When established	1903
Whether research, seed multiplication or demonstration farm	Experimental-*cum*-multiplication and demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	52 inches Lat. 21° N Long. 81° E Alt. 950 ft.
Soil type	Sandy loam, loam and clayey loam
Programme of research	Breeding of paddy, agronomic research on gram, wheat and paddy

3. Government Experimental Farm, Chhindwara

Address and distance from Railway Station	Chhindwara, Madhya Pradesh; 3 miles from Chhindwara Railway Station
When established	1919
Whether research, seed multiplication or demonstration farm	Experimental-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	39 inches Lat. 20.4° N Long. 78.57° E Alt. 2236 feet
Soil type	Clayey, clayey loam, loam, sandy loam
Programme of research	Agronomic research on wheat, sugarcane, pulses and potatoes

4. Wheat Research Station, Powarkheda

Address and distance from Railway Station	Powarkheda, District Hoshangabad, Madhya Pradesh; 4 miles from Hoshangabad Railway Station; 2 miles from Powarkheda Railway Station
When established	1921
Whether research, seed multiplication or demonstration farm	Research-*cum*-demonstration and seed-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	58 inches Lat. 22.44° N Long. 77.42° E Alt. 980 feet
Soil type	Maryar (clay loam)
Programme of research	Breeding and agronomic research on wheat, *tur*, gram, *til* and linseed and multiplication of seed varieties

5. Government Experimental farm, Bagwai

Address and distance from Railway Station	Harsi Experimental Farm, Bagwai, P.O. Bhitarwar (Gwalior-

	Madhya Pradesh); 14 miles from Dabra C. Railway Station	
When established	1939	
Whether research, seed multiplication or demonstration farm	Research and seed multiplication farm	
State, University or private managed	State managed	
Annual rainfall, latitude, longitude and altitude	27 inches	
	Lat.	25.8° N
	Long.	77.°E
	Alt.	800 feet
Soil type	Alluvial	
Programme of research	Breeding of wheat, rice, agronomical work on above crops	

6. Government Agricultural Research Station, Bhilsa

Address and distance from Railway Station	Bhilsa, Madhya Pradesh; 2 miles from Bhilsa Railway Station	
When established	1944	
Whether research, seed multiplication or demonstration farm	Research-*cum*-multiplication farm	
State, University or private managed	State managed	
Annual rainfall, latitude, longitude and altitude	50 inches	
	Lat.	23.9° N
	Long.	76.8° *E*
	Alt.	1200 feet
Soil type	Black cotton	
Programme of research	Fertilizer trials on wheat, agronomical experiments on *jowar* gram and manurial experiments on paddy	

7. Government Experimental Farm, Bhilsa

Address and distance from Railway Station	Bhilsa, Madhya Pradesh; 1½ miles from Bhilsa (C. Rly)	
When established	1944	
Whether research, seed multiplication or demonstration farm	Research and seed multiplication	
State, University or private managed	State managed	
Annual rainfall, latitude, longitude and altitude	44 inches	
	Lat.	23.9° N
	Long.	76.8° E
	Alt.	1200 feet.
Soil type	Black cotton	
Programme of research	Breeding of wheat, linseed, gram, *jowar* and paddy and agronomical trials on the above crops	

8. Government Experimental Farm, Khargone

Address and distance from Railway Station	Khargone, District Neemar, Madhya Pradesh; 38 miles from Sanawad (W. Rly. Station)	
Whether research, seed multiplication or demonstration farm	Research and seed multiplication farm	
State, University or private managed	State managed	
Annual rainfall, latitude, longitude and altitude	25 inches	
	Lat.	21.9° N
	Long.	74.7° E
	Alt.	900 feet
Soil type	Black cotton	
Programme of research	Breeding *mung*, *urd*, *tur*, gram and cotton and agronomical trials	

9. Government Mechanised Agricultural Research Farm, Poundri

Address and distance from Railway Station	Poundri, Tehsil Pushparajgarh, District Shahdol, Madhya Pradesh; 30 miles from Budhar Railway Station
When established	1951
Whether research, seed multiplication or demonstration farm	Seed multiplication and demonstration farm
State, University or private managed	State managed
Annual rainfall	65 inches

Soil type	Rocky soil-mixed with humus, popularly called black cotton
Programme of research	Varietal trials of wheat, gram and paddy

10. Government Mechanised Agricultural Research Farm, Kuthulia

Address and distance from Railway Station	Kuthulia, P.O. Rewa, Madhya Pradesh; 4 miles from Rewa O/A and 36 miles from Satna Railway Station
When established	
Whether research, seed multiplication or demonstration farm	Mechanised farm with research and seed multiplication and demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	45 inches
Soil type	Light black, cotton type
Programme of research	Vegetable scheme and varietal and agronomic trials on wheat, linseed, sugarcane, etc.

11. Government Mechanised Agricultural Research Farm, Reora

Address and distance from Railway Station	Reora, District Satna, Madhya Pradesh; 8 miles from Satna Railway Station
When established	1952
Whether research, seed multiplication or demonstration farm	Research, seed multiplication and demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	42 inches
Soil type	Ligh black soil deficient in humus and nitrogen
Programme of research	Agronomic trials on wheat and gram

12. Government Central Agricultural Research Farm, Nabi Bagh

Address and distance from Railway Station	Nabi Bagh, Bhopal, Madhaya Pradesh; 4 miles from Bhopal Railway Station
When established	1920
Whether research, seed multiplication or demonstration farm	Research-*cum*-seed multiplication and demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	40 inches Lat. 23.15° N Long. 77.24° E Alt. 1624 feet
Soil type	Black cotton soil
Programme of research	Agronomic research on cereals and pulses, weed-control scheme and fodder research scheme experiments. Varietal and manurial trials and testing for pests on gram and wheat. Other crops dealt with are paddy, sugarcane, *jowar*, cotton, pulses and oilseeds

13. Government Agricultural Research Farm, Phanda

Address and distance from Railway Station	Phanda, District Sehore, Madhya Pradesh ; 14 miles from Bhopal Railway Station on Bhopal-Sehore Road
Whether research, seed multiplication or demonstration farm	Dry farming demonstration farm
State, University or private managed	State managed
Programme of research	Research on soil conservation methods and demonstration

14. Central Research Farm, Gwalior

Address and distance from Railway Station	Gwalior, District Gird, Madhya Pradesh; One mile from Gwalior Central Railway Station
When established	1916
Whether research, seed multiplication or demonstration farm	Research and seed multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	29 inches Lat. 26.1° N Long. 77° E Alt. 735 feet

Soil type	Alluvial
Programme of research	Breeding of wheat, linseed potato, *jowar*, sesamum, pulses. Agronomical and manurial, pathological and entomological work

15. Agricultural Research Institute, Gwalior

Address and distance from Railway Station	Gwalior, District Gird, Madhya Pradesh ; 1½ miles from Gwalior Railway Station
When established	1918
Whether research, seed multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	29.7 inches Lat. 26.13° N Long. 78.14° E Alt. 680 feet
Soil type	Sandy loam
Programme of research	Manurial and mixed cropping experiments on *jowar* and manurial experiments on wheat, sesamum and pulses

16. Rafi Ahmed Kidwai Institute, Government Research Farm, Sehore

Address and distance from Railway Station	Sehore, Madhya Pradesh ; 2 miles from Sehore Railway Station
When established	1956
Whether research, seed multiplication or demonstration farm	Experimental-*cum*-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	59 inches Lat. 28.12° N Long. 77.05° E Alt. 1667 feet
Soil type	Medium black soil with patches of yellow and reddish soils.
Programme of research	Testing and acclimatisation of improved varieties of sugarcane. Other crops under study are wheat, gram, *jowar* and cotton.

17. Horticultural Research Station, Pachmarhi

Address and distance from Railway Station	Pachmarhi, District Hoshangabad, Madhya Pradesh ; 32 miles from Piparia Railway Station
When established	1950
Whether research, seed multiplication or demonstration farm.	Research farm
State, University or private managed	State managed
Programme of research	Top working of inferior types of trees to superior commercial varieties. Finding out new methods of propagation of fruit trees. Production of seeds of temperate vegetables such as cauliflower, cabbage and knolkhol. Introduction of different kinds and varieties of fruit trees and selection of the varieties which do best under Pachmarhi conditions; introduction of crops of economic importance such as coffee, derris, annato dye, etc.

18. Government Mechanised Agricultural Farm, Tikamgarh

Address and distance from Railway Station	Tikamgarh, Madhya Pradesh 38 miles from Lalitpur Railway Station
When established	1952
Whether research, seed multiplication or demonstration farm	Seed multiplication and demonstration farm
State, University or private managed	State managed
Annual rainfall	45 inches
Soil type	Sandy loam muram mixed

Programme of research	Varietal trials of wheat, gram, paddy and other agronomic trials

19. Government Seed and Demonstration Farm, Betul

Address and distance from Railway Station	Betul District, Madhya Pradesh ; 4 miles from Betul Railway Station
When established	1919
Whether research, seed multiplication or demonstration farm	Seed multiplication and demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	18 inches alt. 2000 feet
Soil type	Loamy
Programme of research	Research on wheat

20. Government Seed and Demonstration Farm, Damoh

Address and distance from Railway Station	Damoh, District Saugar, Madhya Pradesh ; 1½ miles from Damoh Railway Station
When established	1916
Whether research, seed multiplication or demonstration farm	Seed multiplication and demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	61 inches Lat. 24° N Long. 79° E Alt. 2000 feet
Soil type	Loam (patarua and domatta)
Programme of research	Agronomic research on paddy, wheat, peas and gram

21. Government Seed and Demonstration Farm, Durg

Address and distance from Railway Station	Durg ; one mile from Durg Railway Station
When established	1917
Whether research, seed multiplication or demonstration farm	Demonstration-*cum*-seed multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	47 inches Lat. 11.25° N Long. 79° E Alt. 1000 feet
Soil type	Sandy loam and loamy (Bhata, Matasi, Kanhar)
Programme of research	Agronomic research on paddy, sugarcane, wheat and pulses

22. Government Seed and Demonstration Farm, Khandwa

Address and distance from Railway Station	Khandwa, District Nimar, Madhya Pradesh ; 3 miles from Khandwa Railway Station
When established	1920
Whether research, seed multiplication or demonstration farm	Demonstration-*cum*-seed multiplication farm
State, University or private managed	State managed
Annual rainfall	30 inches
Soil type	Black cotton (Morand No. 2)
Programme of research	Agronomic research on cotton, groundnut, fruits and miscellaneous crops

23. Government Seed and Demonstration Farm, Sagar

Address and distance from Railway Station	Sagar, Madhya Pradesh ; 3 miles from Sagar Railway Station
When established	1918
Whether research, seed multiplication or demonstration farm	Demonstration-*cum*-seed multiplication farm
State, University or private managed	State managed

Annual rainfall, latitude, longitude, and altitude	45 to 48 inches Lat. 24° N Long. 70° E
Soil type	Light black clay loam
Programme of research	Agronomic research on wheat, gram, *jowar* and paddy

24. Government Seed and Demonstration Farm, Waraseoni

Address and distance from Railway Station	Waraseoni, District Balaghat, Madhya Pradesh ; 2 miles from Waraseoni
When established	1917
Whether research, seed multiplication or demonstration farm	Seed multiplication and demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	59 inches Lat. 80.5° N Long. 21.45° E Alt. 989 feet
Soil type	Sandy loam and loamy (Sihar Morand I and Morand II)
Programme of research	Agronomic trials on wheat, gram, sugarcane, linseed, paddy and vegetable crops

25. Seed and Demonstration Farm, Bilaspur

Address and distance from Railway Station	Bilaspur, Madhya Pradesh ; 4 miles from Bilaspur Railway Station
When established	1918
Whether research, seed multiplication or demonstration farm	Seed-*cum*-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	55 inches
Soil type	Sandy loam (Matesi)
Programme of research	Agronomic trials on groundnut, sugarcane, paddy, fruits and miscellaneous crops

26. Seed Multiplication and Demonstration Farm, Dindori

Address and distance from Railway Station	Dindori, District Mandla, Madhya Pradesh ; 64 miles from Mandla Railway Station
When established	1936
Whether research, seed multiplication or demonstration farm	Seed multiplication-*cum*-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	55 inches Lat. 30° N Long. 81° E Alt. 1227 feet
Soil type	Black clayey soil
Programme of research	Agronomic trials on paddy, wheat, gram, kulthi, niger, *tur*, konkon and multiplication of seed varieties

27. Government Seed and Demonstration Farm, Seoni

Address and distance from Railway Station	Seoni, District Seoni, Madhya Pradesh ; 1 mile from Seoni (S-E. Rly)
When established	1919
Whether research, seed multiplication or demonstration farm	Seed-multiplication and demonstration farm
State, University or private managed	State managed
Soil type	Loamy and loamy clay
Programme of research	Agronomic trials on wheat, sugarcane, paddy, etc. and research on fodder grasses

28. Government Seed and Demonstration Farm, Jagdalpur

Address and distance from Railway Station	Kumrawarid Farm, Jagdalpur, District Bastar, 128 miles from Dhamtari, 4 miles from Jagdalpur on Jagdalpur-Centrahut Road
Whether research, seed multiplication or demonstration farm	Seed multiplication and demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	60 inches
Soil type	Loamy
Programme of research	Agronomic trials on paddy

29. Government Seed-*cum*-Demonstration Farm, Raisen

Address and distance from Railway Station	Raisen, Madhya Pradesh ; 14 miles from Salamatpur Railway Station
When established	1944
Whether research, seed multiplication or demonstration farm	Seed multiplication and demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	53 inches Lat. 23.19° N Long. 77.41° E Alt. 1428 feet
Soil type	Black cotton soil
Programme of research	Varietal tests on wheat and gram. Other crops dealt with are *jowar*, paddy and cotton. Dry farming demonstration farm

30. Government Seed-*cum*-demonstration Farm, Amlaha

Address and distance from Railway Station	Amlaha Farm, District Sehore, Madhya Pradesh ; 15 miles from Sehore Railway Station
When established	1938
Whether research, seed multiplication or demonstration farm	Dry farming demonstration farm
Annual rainfall, latitude, longitude and altitude	51 inches Lat. 23.07° N Long. 76.54° E Alt. 1612 feet
Soil type	Medium black cotton soil
Programme of research	Varietal, manurial and acclimatisation trials on cotton, *jowar*, wheat and gram

31. Government Seed-*cum*-demonstration Farm, Sultanpur

Address and distance from Railway Station	Sultanpur, District Raisen, Madhya Pradesh ; 28 miles from Obeidullahaganj Railway Station
When established	1951
Whether research, seed multiplication or demonstration farm	Canal irrigated-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	48 inches Lat. 23.08° N Long. 77.59° E Alt. 1180 feet
Soil type	Black cotton soil
Programme of research	Varietal and manurial trials on paddy. Other crops dealt with are cotton, chillies, gram and wheat

32. Government Seed-*cum*-Demonstration Farm, Obeidullahaganj

Address and distance from Railway Station	Obeidullahaganj, District Raisen, 25 miles from Bhopal City

Whether research, seed multiplication or demonstration farm	Research-*cum*-seed multiplication and demonstration farm
State, University or private managed	State managed
Programme of research	Fertiliser experiments under modern agronomic trial scheme of the I.C.A.R.

33. Government Seed-*cum*-Demonstration Farm, Kaliprade-Kararia

Address and distance from Railway Station	Kaliprade, Bhopal, Madhya Pradesh half mile (Kaliprade farm and 2 miles (Kararia Sewage farm) from Bhopal Raiway Station
Whether research, seed multiplication or demonstration farm	Seed multiplication at Kaliprade and sewage utilisation demonstration at Kararia
State, University or private managed	State managed
Programme of research	Sewage water utilisation on vegetables, sugarcane, betel-vine and banana

34. Government Farm, Bhind

Address and distance from Railway Station	Bhind, Madhya Pradesh ; District Bhind ; one mile from Bhind Railway Station
When established	1955
Whether research, seed multiplication or demonstration farm	Proposed to be utilised for research
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	25 inches Lat. 26.5° N Long. 77.8° E Alt. 523 feet
Soil type	Alluvial
Programme of research	Seed multiplication of wheat, *jowar*, gram and pea

35. Government Farm, Sheopur

Address and distance from Railway Station	Government Agricultural Farm, Sheopur (Baroda), District Morena, Madhya Pradesh ; 14 miles from Sheopur-Kalan Railway Station
When established	1955
Whether research, seed multiplication or demonstration farm	Proposed to be utilised for research
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	25 inches Lat. 25.4° N Long. 75.8° E Alt. 731 feet
Soil type	Alluvial
Programme of research	Seed multiplication of *jowar*, wheat, linseed

36. Government Farm, Jora

Address and distance from Railway Station	Government Agricultural farm, (Alapur), Jora District Morana ; 1 mile from Jora Railway Station
When established	1955.
Whether research, seed multiplication or demonstration farm	Proposed to be utilised for research
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	27 inches Lat. 26.3° N Long. 77.0° E Alt. 700 feet
Soil type	Alluvial
Programme of research	Seed multiplication of *jowar*, wheat, pea and gram

37. Government Farm, Biora

Address and distance from Railway Station	Biora, District Rajgarh, Madhya Pradesh ; 60 miles from Bhopal Railway Station

When established	1955
Whether research, seed multiplication or demonstration farm	Seed multiplication and demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	36 inches Lat. 23.9° N Long. 27.9° E Alt. 1800 feet
Soil type	Black cotton
Programme of research	Seed multiplication

38. Government Farm, Guna

Address and distance from Railway Station	Guna, District Guna, Madhya Pradesh ; 1 mile from Guna Railway Station
When established	1956
Whether research, seed multiplication or demonstration farm	Seed multiplication and demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	36 inches Lat. 24.6° N Long. 76.8° E Alt. 1800 feet
Soil type	Black cotton
Programme of research	Seed multiplication of *jowar,* wheat, pea and gram

39. Government Farm, Ujjain

Address and distance from Railway Station	Ujjain, Madhya Pradesh ; 3 miles from Ujjain Railway Station (C. Rly.)
When established	1918
Whether research, seed multiplication or demonstration farm	Seed multiplication and demonstation farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	35 inches Lat. 23.2°N Long. 74.8°E Alt. 1800 feet
Soil type	Black cotton
Programme of research	Seed multiplication and model agronomic trials

40. Government Farm, Indore

Address and distance from Railway Station	Indore, Madhya Pradesh ; 5 miles from Indore Railway Station (W. Rly.)
Whether research, seed multiplication or demonstration farm	Seed multiplication
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	35 inches Lat. 22.7°N Long. 74.9°E Alt. 1805 feet
Soil type	Black cotton
Programme of research	Seed multiplication

41. Government Farm, Mahagarh

Address and distance from Railway Station	Mahagarh, P.O. Manasa, District Mandsaur ; 29 miles Piplia Railway Station
Whether research, seed multiplication or demonstration farm	Seed multiplication
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	30 inches Lat. 24.4°N Long. 74.2°E Alt. 1500 feet

Soil type	Black cotton
Programme of research	Seed multiplication

42. Government Farm, Jhabua

Address and distance from Railway Station	Jhabua, Madhya Pradesh ; 13 miles from Meghnagar Railway Station, (W. Rly.)
When established	1956
Whether research, seed multiplication or demonstration farm	Proposed to be utilised for research
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	24 inches Lat. 22.9°N Long. 73.5°E Alt. 1700 feet
Soil type	Black cotton
Programme of research	Seed multiplication

43. Government Farm, Badnawar

Address and distance from Railway Station	Badnawar, District Dhar, Madhya Pradesh
When established	1954
Whether research, seed multiplication, or demonstration farm	Cotton research *cum* demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	35 inches Lat. 23.1°N Long. 74.2°E Alt. 1800 feet
Soil type	Black cotton
Programme of research	Breeding long staple cotton for Malwa

44. Government Mechanised Agricultural Farm, Samda

Address and distance from Railway Station	Samda, Tehsil and District Sidhi, Madhya Pradesh ; 142 miles from Satna Railway Station
When established	1955
Whether research, seed multiplication or demonstration farm	Seed multiplication and demonstration farm
State, University or private managed	State managed
Annual rainfall	50 inches
Soil type	Loam

45. Government Mechanised Agriculture Farm, Mau

Address and distance from Railway Station	Mau (Nowgong), Tehsil and District Chattarpur, Madhya Pradesh ; 23 miles from Harpalpur Railway Station
When established	1954
Whether research, seed multiplication or demonstration farm	Seed multiplication and demonstration farm
State, University or private managed	State managed
Annual rainfall	45 inches
Soil type	Light black cotton and sandy loam
Programme of research	Varietal trials of wheat, groundnut, sugarcane and agronomical trials

46. Government Mechanised Agriculture Farm, Datia

Address and distance from Railway Station	Datia, Madhya Pradesh ; 3 miles from Datia Railway Station
When established	1954
Whether research, seed multiplication or demonstration farm	Seed multiplication and demonstration farm
State, University or private managed	State managed
Annual rainfall	23 inches
Soil type	Sandy loam and light black cotton
Programme of research	Varietal trials of wheat and other agronomical trials

47. Government Seed-*cum*-Demonstration Farm, Ajaigarh

Address and distance from Railway Station	Ajaigarh, District Panna, Madhya Pradesh, 56 miles from Banda Railway Station
When established	1944
Whether research, seed multiplication or demonstration farm	Seed multiplication and demonstration farm
State, University or private managed	State managed
Annual rainfall	45 inches
Soil type	Sandy loam
Programme of research	Varietal trials of wheat, gram, linseed, *jowar* and agronomical trials

48. Government Seed-*cum*-Demonstration Farm, Bijawar

Address and distance from Railway Station	Bijawar, District Chhatarpur, Madhya Pradesh; 55 miles from Harpalpur Railway Station
When established	1945
Whether research, seed multiplication or demonstration farm	Seed multiplication and demonstration farm
State, University or private managed	State managed
Annual rainfall	45 inches
Soil type	Sandy loam
Programme of research	Varietal trials of wheat, gram, linseed, sugarcane and other agronomic trials

49. Government Seed-*cum*-Demonstration Farm, Nowgong

Address and distance from Railway Station	Nowgong, Tahsil and District Chhatarpur, Madhya Pradesh ; 19 miles from Harpalpur Railway Station
When established	1944
Whether research, seed multiplication or demonstration farm	Demonstration farm for the Extension Training Centre
State, University or private managed	State managed
Annual rainfall	45 inches
Soil type	Black cotton soil
Programme of research	Varietal trials of wheat, paddy, *jowar*, linseed, gram and other agronomic trials

50. Government Seed-*cum*-Demonstration Farm, Tijni

Address and distance from Railway Station	Tijni (Hanumana) Tahsil Nawganj, District Rewa, Madhya Pradesh; 90 miles from Satna Railway Station and 39 miles from Mirzapur
When established	1952
Whether research, seed multiplication or demonstration farm	Seed multiplication and demonstration farm
State, University or private managed	State managed
Annual rainfall	45 inches
Soil type	Black, cotton type (soil deposit upto 2 or 3 feet)
Programme of research	Varietal trials of wheat, gram, and paddy and other agronomic trials

51. Government Mechanised Agricultural Farm, Janakpur

Address and distance from Railway Station	Janakpur, Tahsil and District Satna, Madhya Pradesh ; 50 miles from Satna Railway Station
When established	1952
Whether research, seed multiplication or demonstration farm	Seed multiplication and demonstration farm
State, University or private managed	State managed
Annual rainfall	45 inches
Soil type	Sandy loam, domat
Programme of research	Varietal trials of wheat, gram, paddy, sugarcane and other agronomic trials

52. Vegetable Seed Farm, Silari

Address and distance from Railway Station	Silari near Piparia (Central Railway), Madhya Pradesh ; 1 mile from Piparia Railway Station
When established	1950
Whether research, seed multiplication or demonstration farm	Multiplication farm
State, University or private managed	State managed
Programme of research	Botanical survey of vegetable crops to evolve better varieties by simple selection from the collection made. Collection of improved strains of Indian types of vegetables evolved at other places by selection and hybridisation and to select varieties best suited to the region by conducting field trials. Trials on cultural practices and different manures. Investigation on important diseases and pests. Good varieties of *bhindi*, chillies, cluster, beans brinjal, sponge gourd, tomato, onion, and pea have been selected and their seeds are being multiplied and distributed.

MADHYA PRADESH

ANIMAL HUSBANDRY RESEARCH STATIONS

1. Government Vaccine and Research Institute, Gwalior

Address and distance from Railway Station	Hazurat Road, Gwalior, Madhya Pradesh ; 3½ miles from Gwalior Railway Station
When established	1949
State, University or private managed	State managed
Programme of research	The research is restricted to improvement of quality of biological products and common diseases of livestock. The usual functions are production of biologicals on a large-scale and disease investigation.

MADRAS

AGRICULTURAL RESEARCH STATIONS

1. Agricultural Research Station, Aduturai

Address and distance from Railway Station	Aduturai, District Tanjore, Madras ; 4 furlongs from Aduturai Railway Station
When established	1922
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	35 inches Lat. 11°N Long. 79.30°E Alt. 63.89 feet
Soil type	Clayey alluvium (The Cauvery delta)
Programme of research	Varietal, manurial and cultural trials on paddy, cotton, vegetables and fruits

2. Agricultural Research Institute, Coimbatore

Address and distance from Railway Station	Coimbatore, Madras ; about 4 miles from Coimbatore Railway Station
When established	1906
Whether research, multiplication or demonstration farm	Main Research Institute of Madras State for Agriculture Department
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	26 inches Lat. 11°N Long. 77.38°E Alt. 1400 feet
Soil type	Red sandy loam, loams, black soils
Programme of research	The programme comprises investigations on agricultural problems by various Sections of (1) Chemistry (2) Entomology (3) Mycology (4) Paddy (5) Millets and Pulses (6) Oil Seeds (7) Cotton (8) Horticulture (9) Botany (10) Agronomy (11) Agricultural Engineering

3. Agricultural Research Station, Koilpatti

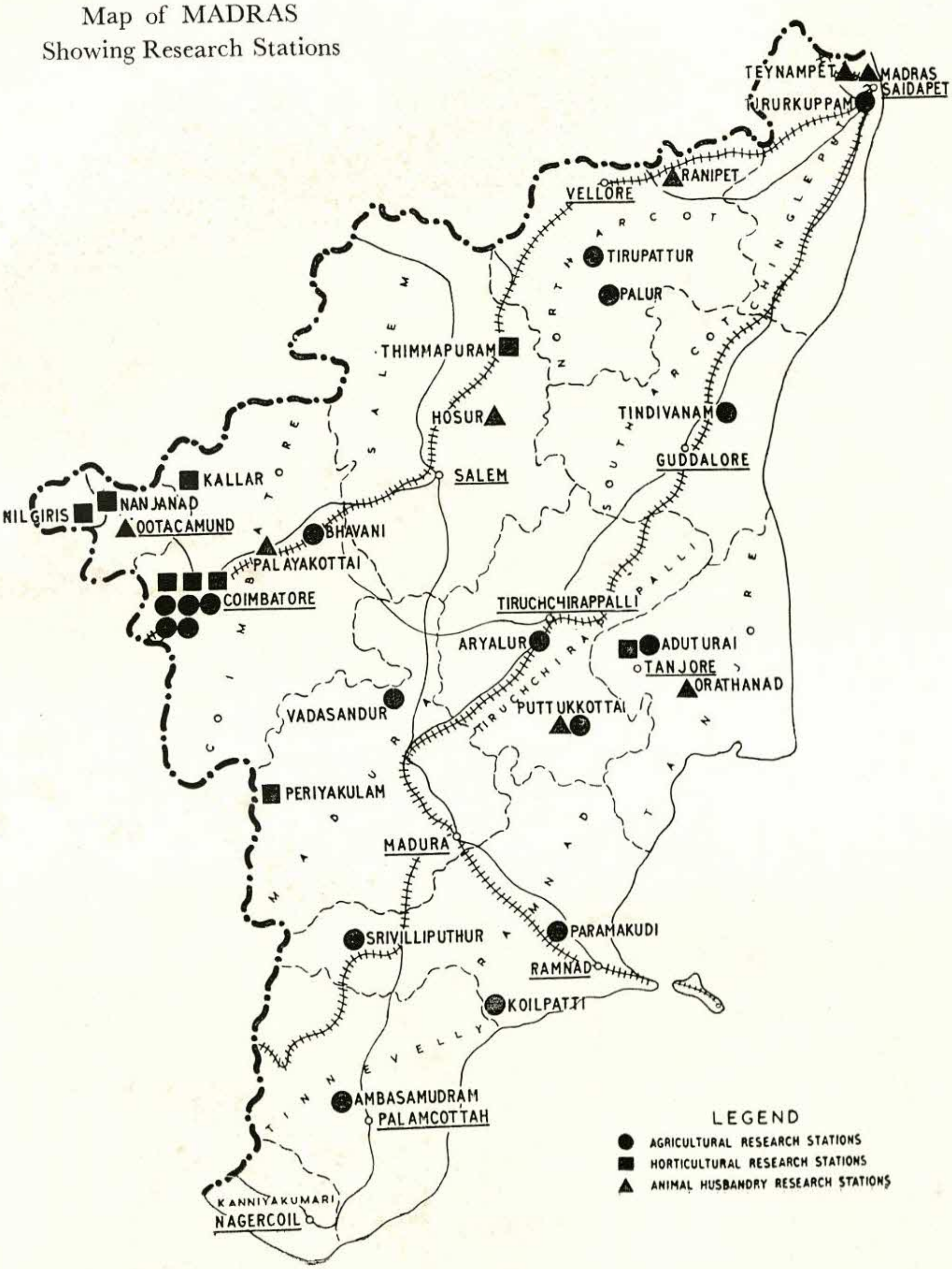
Address and distance from Railway Station	Koilpatti, District Tirunelveli, Madras; 3 furlongs from Koilpatti Railway Station
When established	1900
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	30 inches Lat. 9.12°N Long. 77.53°E Alt. 546 feet
Soil type	Red loam, black clay
Programme of research	Varietal, manurial, cultural trials, etc. on *Irungu cholam* and *Vellai cholam*

4. Agricultural Research Station, Nanjanad

Address and distance from Railway Station	Nanjanad, District Nilgiris, Madras; 10⅛ miles from Ootacamund Railway Station

[PLATE LXXIII

Map of MADRAS
Showing Research Stations



When established	1917
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall	57 inches
Soil type	Sandy loam
Programme of research	Varietal, cultural and manurial trials on potato

5. Agricultural Research Station, Palur

Address and distance from Railway Station	Palur, Nellikuppam, District South Arcot, Madras; 5 miles from Nellikuppam Railway Station
When established	1905
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication-*cum*-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	51 inches Lat. 12°N Long. 79°E Alt. 58 feet
Soil type	Loam to clay
Programme of research	Varietal and manurial trials on *ragi*, paddy, groundnut, cotton and sugarcane. Intensive work on sugarcane is recently started under the direct control of the Sugarcane Specialist

6. Agricultural Research Station, Paramakudi

Address and distance from Railway Station	Paramakudi, District Ramanathapuram, Madras; one mile from Paramakudi Railway Station
When established	1953
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall	34 inches
Programme of research	Evolution of strains to suit the tract, through all the well recognised methods of plant breeding with special emphasis on breeding drought-resistant and semi-dry varieties of paddy

7. Agricultural Research Station, Pattukottai

Address and distance from Railway Station	Pattukkottai, District Tanjore, Madras; 1 mile from Pattukkottai Railway Station
When established	1935
Whether research, multiplication or demonstration farm	Research-*cum*-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	37 inches Lat. 10°N Long. 79°E Alt. 75 feet
Soil type	Red sandy loam
Programme of research	Research work on paddy, groundnut, cotton, etc.

8. Agricultural Research Station, Bhavani Sagar

Address and distance from Railway Station	Lower Bhavani, District Coimbatore, Madras; 39 miles from Erode Railway Station
When established	1951
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Programme of research	Agronomic research on important cereals, legumes, cotton, groundnut, etc. to evolve a suitable rotation for the dryland area to be irrigated by the Bhavani project; also determining method of soil amendment and judicious irrigation of crops

9. Agricultural Research Station, Tindivanam

Address and distance from Railway Station	Tindivanam, District South Arcot, Madras; 2 miles from Tindivanam Railway Station

When established	1935
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	36 inches Lat. 12.14°N Long. 74.42°E Alt. 144 feet
Soil type	Red sandy loam
Programme of research	The programme of research mainly consists of breeding high yielding strains of the three oilseeds, viz. groundnut, gingelly and castor, with various quality attributes, resistance to pests and diseases and agronomic experiments to determine the economic, manurial cultural and rotational practices for the three crops

10. Central Banana Research Station, Aduthurai

Address and distance from Railway Station	Aduthurai, District Tanjore, Madras; one mile from Aduthurai Railway Station
When established	1949
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	35 inches Lat. 11°N Long. 79.30°E Alt. 63.89 feet
Soil type	Alluvial clay to clayey loam with a small portion sandy to sandy loam
Programme of research	Varietal trials of banana from Ceylon, Malaya, West Indies and Australia ; manurial and cultural trials on banana

11. Central Farm, Coimbatore

Address and distance from Railway Station	Coimbatore, Madras; 3½ miles from Coimbatore Railway Station
When established	1909
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	26 inches Lat. 10°N Long. 77°E Alt. 1406 feet
Soil type	Black loam and red loam
Programme of research	Irrigation experiments and research work on paddy, *cholam*, cotton, etc.

12. College Orchard, Coimbatore

Address and distance from Railway Station	Coimbatore, Madras; 3½ miles from Coimbatore Railway Station
When established	1930
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Programme of research	The following items of research are under progress : 1) Hybridisation in sapotas 2) Hybridisation in bananas 3) Improvement of papaya 4) Improvement of vegetable crops such as *bhendi*, brinjal and tomato

13. Cotton Breeding Station, Coimbatore

Address and distance from Railway Station	Agricultural College and Research Institute, Lawley Road Post; 4½ miles from Coimbatore Railway Station

When established	1920
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Programme of research	Evolving long stapled American cotton suited to winter season in the irrigated garden lands of southern districts, increasing the lint per acre through high cotton yields, ginning percentage and resistance to adverse environmental factors, pests or diseases. Unification of Cambodia tract under a strain capable of adjusting itself in the different farming systems in vogue; introduction and trial on exotic perennial cotton possessing good lint quality with drought and disease resistance, introducing useful genus from wild species for the improvement of cultivated races of cotton, evolving Karunganni strains. Superior to Karunganni 5 in yield, ginning percentage and lint length and fundamental studies on inheritance of characters

14. Millet Breeding Station, Coimbatore

Address and distance from Railway Station	Coimbatore,Madras; 4½ miles from Coimbatore Railway Station
When established	1923
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	25 inches Lat. 11°N Long. 77°E Alt. 1400 feet
Soil type	Red sandy loam
Programme of research	Evolving high yielding and short duration variety of millet and sorghum; work is also being carried on finger millet, Italian millet and minor millets

15. Model Orchard Centre, Periyakulam

Address and distance from Railway Station	Periyakulam, District Madurai, Madras; 24 miles from Kodaikanal Road Railway Station
When established	1952
Whether research, multiplication or demonstration farm	Demonstration farm
State, University or private managed	State managed
Programme of research	Only a demonstration farm

16. Model Orchard Centre, Thimmapuram

Address and distance from Railway Station	Thimmapuram, District Salem, Madras; 24 miles from Samelpatti Railway Station
When established	1952
Whether research, multiplication or demonstration farm	Demonstration farm
State, University or private managed	State managed
Programme of research	Demonstration farm only

17. Oilseeds Breeding Station, Coimbatore

Address and distance from Railway Station	Coimbatore, Madras; 3 miles from Coimbatore Railway Station
When established	1949
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	25 inches Lat. 11°N Long. 77°E Alt. 1,400 feet
Soil type	Red loam
Programme of research	Collection of sunflower, linseed, castor and groundnut varieties and testing them for better growth and quality and raising quality seedlings of coconut

18. Paddy Breeding Station, Coimbatore

Address and distance from Railway Station	Coimbatore, Madras; 5 miles from Coimbatore Railway Station
When established	1913
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	26 inches Lat. 11°N Long. 77°E Alt. 2400 feet
Soil type	Clayey loam (black cotton type)
Programme of research	Improvement of rice by selection and hybridisation for evolving new strains of different durations resistant to blast and cultural and manurial experiments

19. Pomological Station, Nilgiris

Address and distance from Railway Station	District Nilgiris, Madras; 2 miles from Coonoor Railway Station
When established	1920
Whether research, multiplication or demonstration farm	Research station
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	45 to 60 inches Alt. 5600 feet
Soil type	Lateritic red loams
Programme of research	Trials with nearly 25 kinds of vegetables resulted in the selection of large cabbage and a selection of cauliflower. Research work on beans, tomatoes, apple, plum, pear, peach and persimmon is being done

20. Regional Millet Station, Tirupattur

Address and distance from Railway Station	Tirupattur, District North Arcot, Madras; 1½ mile from Tirupattur Railway Station
When established	1949
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Programme of research	Breeding and agronomical studies on millets and pulses

21. Regional Millet Station, Ariyalur

Address and distance from Railway Station	Rajaji Nagar, District Tiruchirupalli, Madras; ½ mile from Ariyalur Railway Station
When established	1949
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Programme of research	Breeding (i) *Sorghum* (*Sorghum* species) (ii) *Bajra* (*Penniseium typhoides* Sandh) (iii) *Ragi* (*Eleusine coracana* Gartn). and (iv) *Varagu* (*Paspalum scrobiculatum*, Linn.) for high yield of grain and straw

22. Research Farm, Srivilliputhur

Address and distance from Railway Station	Srivilliputhur, District Ramanathapuram, Madras; 1 mile from Srivilliputhur Railway Station
When established	1950
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	36 inches Lat. 9.31° N Long. 77.4° E Alt. 453 feet

Soil type	Black clayey loam
Programme of research	Breeding long staple American cotton possessing 1⅛ in. staple capable of maturing in about 5½ months suitable for being cultivated as a summer crop between the months of March and August in tank-fed wetlands

23. Rice Research Station, Ambasamudram

Address and distance from Railway Station	Ambasamudram, District Tirunelveli, Madras; 2 miles from Ambasamudram Railway Station
When established	1937
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	41 inches Lat. 8.42° N Long. 77.28° E Alt. 220 feet
Soil type	Clay loam to light clay
Programme of research	Selection and hybridisation of local varieties, introduction of new varieties and cultural experiments and manurial experiments on rice

24. Rice Research Station, Tirurkuppam

Address and distance from Railway Station	Tirurkuppam, District Chingleput, Madras; 1 mile from Sevapet Road Railway Station
When established	1942
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	53.27 inches Lat. 13° N Long. 80° E Alt. 132 feet
Soil type	Sandy loam
Programme of research	Research on paddy selection, hybridisation, manurial experiments and mixed cropping

25. Sub-tropical Fruit and Spice Research Station, Burliar

Address and distance from Railway Station	Burliar, District Coimbatore, Madras; 3 miles from Hillgrove Railway Station
When established	1874
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	59 inches Lat. 12° N Long. 77° E Alt. 2500 feet
Soil type	Rich organic loam
Programme of research	Research on horticultural crops such as clove, nutmeg, cocoa, etc.

26. Sugarcane Research Station, Gudiattam

Address and distance from Railway Station	Gudiattam, Madras; 1½ miles from Milalattur Railway Station
When established	1935
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Programme of research	To select high yeilding and useful types of sugarcane and to determine the optimum manurial and cultural schedules for this tract comprising of the central districts of the State in varietal, cultural and manurial items

27. Tropical Fruit Research Station, Kallar

Address and distance from Railway Station	Kallar, District Coimbatore, Madras; 6 miles from Mettupalayam Railway Station
When established	1900
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	54 inches Lat. 12° N Long. 77° E Alt. 1400 feet
Soil type	Open orgilic loam
Programme of research	Manurial, varietal and cultural experiments on cocoa, avocado banana, jack, mandarin, orange and mangosteen.

MADRAS

ANIMAL HUSBANDRY RESEARCH STATIONS

1. District Livestock Farm, Pudukottai

Address and distance from Railway Station	Pudukottai, District Tiruchirapalli, Madras; 1 mile from Pudukottai Railway Station
When established	1951
State, University or private managed	State managed
Programme of research	Cattle breeding, dairying and cultivation of fodder crops for the cattle are the main activities of the farm

2. Kangayam Cattle Improvement Scheme, Palayakottai

Address and distance from Railway Station	Pudur, Palayakottai P.O., Madras; 21 miles from Erode Railway Station
When established	1942
State, University or private managed	State managed
Programme of research	i) To select breeding bulls with the object of producing daughters of high milking capacity ii) To watch the milk yield of daughters produced iii) To watch the capacity of the male progeny for producing daughters of high milk yielding capacity in relation to milk yield iv) To watch the capacities of the male progeny for the work v) To study the early maturity of heifers vi) To study the prenatal treatment vii) To study the birth weight of calves and their rate of growth upto six months viii) Maintenance of pedigree records

3. Livestock Research Station, Hosur

Address and distance from Railway Station	Hosur, District Salem, Madras; 25 miles from Malur Railway Station
When established	1924
State, University or private managed	State managed
Programme of research	(1) Breeding of Bikaneri and Bellary breed to improve the wool and mutton quality respectively 2) Grading up the local cows in Madras State by breeding with stud bulls of Sindhi, Kangayam and Gir 3) To evolve a milk strain within the Kangayam breed without affecting the draught qualities. Selective breeding of Sindhi for higher milk production (4) Eradication of Johne's disease

4. Madras Veterinary College, Madras

Address and distance from Railway Station	Vepery High Road, Veprey, Madras; ½ mile from Madras Railway Station
When established	1903
State, University or private managed	State managed
Programme of research	Post-graduate research and other works in the subject of Animal Nutrition, Physiology, Pharmacology, Parasitology, Animal Genetics, Helminthology and Pathology

5. Institute of Veterinary Preventive Medicine, Ranipet

Address and distance from Railway Station	Ranipet, District North Arcot, Madras; 1 mile from Ranipet Railway Station
When established	1932
State, University or private managed	State managed
Programme of research	Manufacturing certain biological products in freeze dried form on modern lines using latest equipments, continuing

the studies on the immunising value of the Johne's disease vaccine manufactured at this Institute, further studies on the immunising value of anthrax spore vaccine and on the protective value of adjuvant vaccines for pasteurollosis and for evolving a safe and efficient vaccine for sheep pox

6. District Livestock Farm, Orthanad

Address and distance from Railway Station	Orthanad, Tanjore District, Madras State; 14 miles from Tanjore junction on the Tanjore—Pattukottai road
When established	1954
State, University or private managed	State managed
Programme of research	1. For breeding Umblachery breed of cows 2. To breed Sindhi and Murrah buffaloes and supply breeding bulls to the public to improve the milk yield of local animals *Poultry*: 3. To supply birds and eggs of White Leghorn and Rhode Island red breeds to the public and also to improve the local country birds in their egg laying capacity and size 4. To try various varieties of grasses and fodder crops in the farm 5. It is also one of the object to have a mixed farm here. Paddy cultivation, pisciculture, apiculture and horticulture are also taken up here to make it a paying concern since dairying alone is not a profitable farming

7. Dunsandle Sheep Farm, Ootacamund

Address and distance from Railway Station	Sheep Farm, Dunsandle; 7 miles from the Ootacamund Railway Station, Nilgiris District, Madras State
When established	managed 1950
State, University or private managed	State managed
Programme of research	1. To standardise the Nilgiris breed of sheep which is noted for its fine wool by selective breeding 2. To improve the quality and quantity of wool, and carcass weight by cross breeding with Romney Marsh and Cheviot rams 3. To supply pedigree rams of Nilgiris breed for field extension work 4. To study the suitable period for doing various seasonal operations as shearing, mating, breeding, etc.

8. Poultry Research Station, Teynampet Madras

Address and distance from Railway Station	Poultry Research Station, Madras; one mile from Mambalam Railway Station and four miles from Madras Central
When established	1941
State, University or private managed	State managed
Programme of research	Breeding of white Leghorn, Rhode Island Red, Black Minorca, Light Sussex, Brown Leghorn varieties of birds 2. Cross breeding of Kalhasti and Denki breed of fowls 3. Building up of resistant strain to avian hencosis complex

9. Salvage of Dry Cows Farm, Kambakkam

Address and distance from Railway Station	Kambakkam; Varadaiyapalayam P.O. Ponneri Taluk, Chingleput District; 12½ miles from Tada Railway Station
When established	1944-45
State, University or private managed	State managed
Programme of research	The object of the "Salvage of Dry Cows Scheme" is to prevent neglect and indiscriminate slaughter of valuable milk cows in the city when they go dry, by maintaining them. This scheme enables not only to preserve the valuable cows but also to improve their breed with suitable breeding bulls and augument the source of milk supply to Madras City

MANIPUR

AGRICULTURAL RESEARCH STATIONS

1. Government Agricultural Farm, Imphal

Address and distance from nearest Railway Station	Dimapur (otherwise termed Manipur Road Railway Station) on N.E. Railway, Assam link—134 miles
When established	1951
Whether research, multiplication or demonstration farm	Research-*cum*-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	60 inches Lat. 24.50°N Long. 93.50°E Alt. 2567′ feet
Soil type	Clayey loam
Programme of research	Varietal, cultural and manurial trial on paddy, maize, wheat, pea, soyabean, potato, chillies and fruits

2. Government Orchard, Imphal

Address and distance from nearest Railway Station	Dimapur (otherwise termed Manipur Road Railway Station) on N.E. Railway, Assam link—134 miles
When established	1956
Whether research, multiplication or demonstration farm	Demonstration farm
State, University or private managed	State
Annual rainfall, latitude, longitude and altitude	60 inches Lat. 24.50°N Long. 93.50°E Alt. 2567 feet
Soil type	Clayey loam
Programme of research	Varietal trials on fruits—pears, peaches, plumps, oranges, (sweet and mandarin types)

3. Government Agricultural Farm, Lamphelpat

Address and distance from nearest Railway Station	Dimapur (otherwise termed Manipur Road Railway Station) N.E. Railway, Assam link—139 miles
When established	1956
Whether research, multiplication or demonstration farm	Research-*cum*-demonstration-*cum*-multiplication
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	60 inches Lat. 24.54°N Long. 93.52°E Alt. 2500 feet
Soil type	Clayey loam
Programme of research	Varietal, cultural and manurial trial on paddy and sugarcane

4. Government Agricultural Farm, Maram

Address and distance from Railway Station	Dimapur (otherwise termed Manipur Road Railway Station) N.E. Railway, Assam link—80 miles
When established	1956
Whether research, multiplication or demonstration farm	Research-*cum*-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	80 inches Lat. 25.30°N Long. 94.10°E Alt. 4850 feet
Soil type	Loam
Programme of research	Varietal, cultural, and manurial trials on maize, wheat, pea, soyabean, potato, fruits (pear, peach, plum and oranges)

5. Government Agricultural Farm, Ukhrul

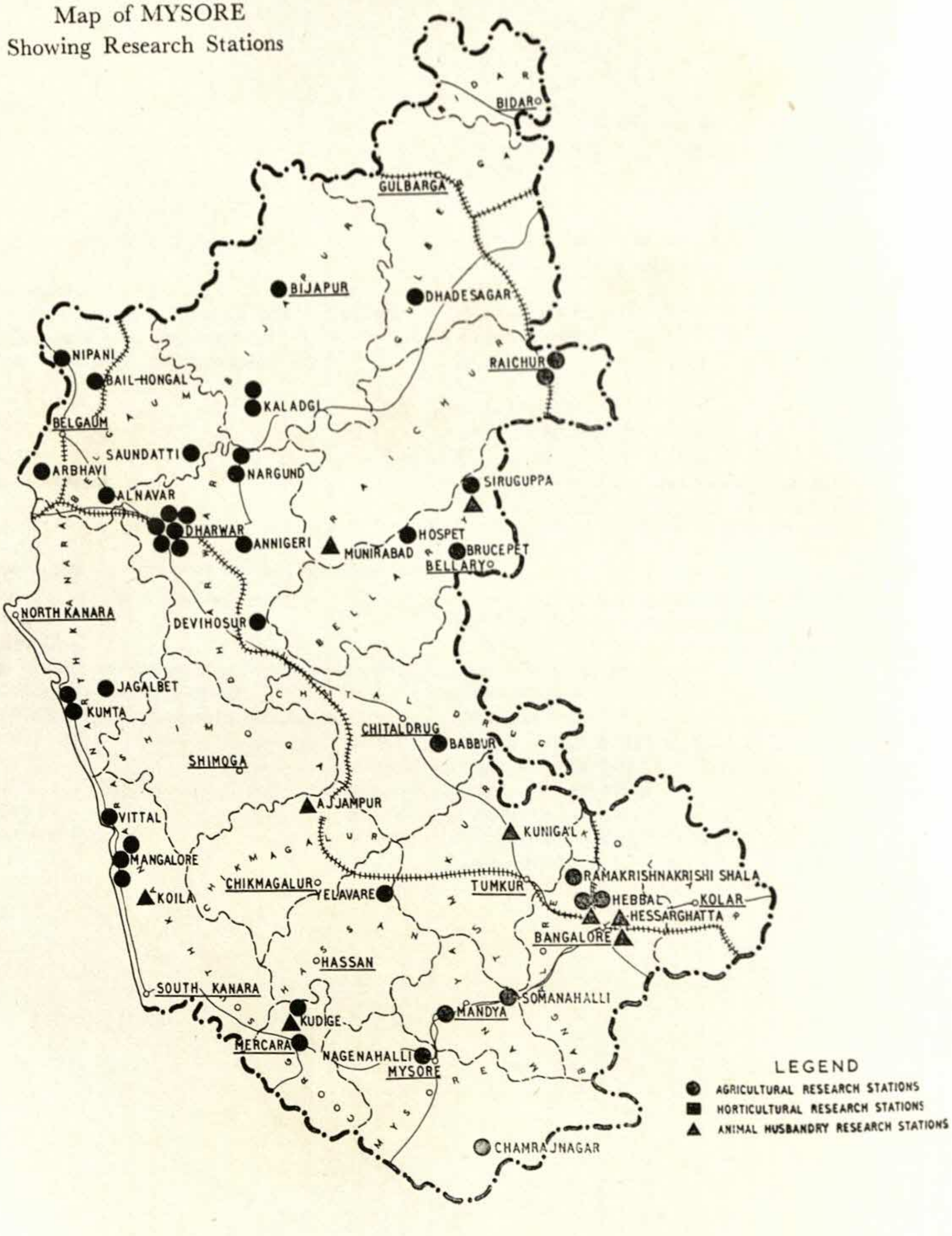
Address and distance from Railway Station	Dimapur (otherwise termed Manipur Road Railway Station) N.E. Railway—Assam link—190 miles
When established	1952
Whether research, multiplication or demonstration farm	Research-*cum*-demonstration
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	80 inches Lat. 25.35°N Long. 94.30°E Alt. 6147 feet
Soil type	Loam
Programme of research	Varietal, cultural and manurial trials on maize, pea, soyabean, potato, fruits (pear, peach, plum, orange, apple and walnut)

6. Government Agricultural Farm, Wangbal

Address and distance from Railway Station	Dimapur (otherwise termed Manipur Road Railway Station) on N.E. Railway-Assam link—150 miles
When established	1954
Whether research, multiplication or demonstration farm	Research-*cum*-demonstration
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	60 inches Lat. 24.20°N Long. 93.20°E Alt. 3144 feet
Soil type	Clayey loam
Programme of research	Varietal, cultural and manurial trials on paddy, wheat, pea, sugarcane, soyabean, cotton, jute, maize, potato, chillies, fruits (pear, peach, plum, orange, banana and mango)

7. Government Agricultural Farm, Churachandpur

Address and distance from Railway Station	Dimapur (otherwise termed Manipur Road Railway Station) on N.E. Railway Assam link,—170 miles
When established	1955
Whether research, multiplication or demonstration farm	Research-*cum*-demonstration
State, University or private managed	State managed
Annual rainfall, latitude, longitude, and altitude	70 inches Lat. 24.10°N Long. 93.30°E Alt. 3813 feet
Soil type	Loam
Programme of research	Varietal, cultural and manurial trials on wheat, pea, soyabean, maize, potato, fruits (pear, peach, plum and oranges).



Map of MYSORE
Showing Research Stations

MYSORE

AGRICULTURAL RESEARCH STATIONS

1. Agricultural Research Station, Brucepet

Address and distance from Railway Station	Brucepet, District Bellary, Mysore; 2 miles from Hagari Railway Station
When established	1936
Whether research, multiplication or demonstration farm	Research- *cum*-multiplication farm
State, University or private managed	State managed
Programme of research	Improvement by plant breeding of millets with a view to isolating a type yielding higher than H. 1 *Sorghum* ; improvement of *setaria* includes isolating a type yielding higher than H. 1 and H. 2 *setaria* released from the station. Collections from the cultivator's fields were tried on the station and two promising cultures H.K. 282 and H.K. 289 were given out for district trials

2. Central Farm, Hebbal

Address and distance from Railway Station	Hebbal, Bangalore P.O., Mysore; 3 miles from Yelahanka Railway Station
When established	1914
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	Government managed
Programme of research	Restricted to field crops like paddy, *ragi*, and groundnut, varietal, manurial, pest control and breeding work on sugarcane, paddy and groundnut

3. Government Experimental Farm, Babbur

Address and distance from Railway Station	Babbur, Hiriyur Taluk, District Chitaldrug, Mysore; 27 miles from Chitaldrug Railway Station
When established	1915
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	22 inches Lat. 13.57°N Long. 76.37°E Alt. 2000 feet
Soil type	Dry land—black cotton, red loam; wet land—red loam, loam, Clayey loam
Programme of research	Evolving new varieties suited for this area by acclimatisation, selection and hybridisation on *sannahatti*, *jola*, *thogary*, paddy, sugarcane, coconut, cotton and castor

4. Haradanahally Regional Farm, Chamarajanagar

Address and distance from Railway Station	Chamarajanagar, Mysore; 3 miles from Chamarajanagar Railway Station
When established	1949
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private manged	State managed
Annual rainfall, latitude, longitude and altitude	18 inches Lat. 11.55°N Long. 77.°E Alt. 2300 feet
Soil type	Clayey loam and red loam
Programme of research	Experiments on food crops which are peculiar to this area. Programme of research includes trials on (i) cotton varieties M.A.5, M.A.9 and Laxmi cottons, (ii) 9 American *jowar* varieties and the local, (iii) castor varieties, (iv) dry land paddy varieties, (v) *ragi* varieties, (vi) Bengal gram varieties, (vii)

Java wheat, (viii) wet land paddy varieties and (ix) green manure crops

5. Paddy Breeding Station, Nagenahalli

Address and distance from Railway Station	Nagenahalli, Sri Krishnarajendra Mills Post, Mysore; 1¼ miles from Nagenahalli Railway Station
When established	1917
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Programme of research	Research work on all agricultural problems of paddy as selection, hybridisation and multiplication and distribution of seeds

6. Regional Farm, Yelavare

Address and distance from Railway Station	Yelavare, Harnahalli P.O. Arsikere Taluk, Mysore; 3 miles from Arsikere Railway Station
When established	1949
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Programme of research	Research on important regional crops of the Arsikere region such as *ragi*, dry land paddy, *jowar*, cotton, groundnut, castor, gingelli and pulses and spices like chillies and coriander, and other agricultural problems

7. Sugarcane Liaison Farm, Hospet

Address and distance from Railway Station	Hospet, District Bellary, Mysore; 1½ miles from Bellary Railway Station
When established	1949
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Programme of research	(i) Trial of early, mid season and late maturing varieties of sugarcane (ii) Agronomical trials on (a) the use of different green manures, (b) the use of different forms and combinations of nitrogenous manures (iii) Cultural experiments on (1) seed rate and spacing (2) different kinds of seed material (iv) Experiments with rotation of crops, sugarcane and paddy (v) Observation plots on the use of press mud cake, different number of irrigation, different seasons of planting, harvests, etc.

8. Tungabhadra Agricultural Research Station, Siruguppa

Address and distance from Railway Station	Siruguppa, District Bellary, Mysore; about 1½ miles from Siruguppa town
When established	1937
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Programme of research	Varietal trials on red gram, groundnut, *ragi*, sweet potato and paddy. Manurial trials on paddy, *jowar*, *korra*, and green manure experiments, rotation of crops as also mixed cropping trials and study on movements of salts in deep and shallow black soils under light and heavy irrigations

9. Visvesvaraya Canal Farm, Mandya

Address and distance from Railway Station	Mandya, Mysore; 7½ miles from Mandya Railway Station
When established	1931
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall	40-50 inches

Programme of research	Cotton breeding, physiological study on Egyptian cotton, sugarcane, pulses; breeding and manurial trials on different crops; crop weather observations, seed multiplication and distribution, and varietal trials

10. Agricultural Research Station, Arbhavi

Address and distance from Railway Station	Arbhavi, District Belgaum, Mysore; 4½ miles from Ghataprabha Railway Station
When established	1948
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	23 inches Lat. 16° N Long. 74.5° E Alt. 1920 feet above sea level
Soil type	Medium black in colour
Programme of research	Research on maize and *tur*; evolution of suitable early high yielding, single and three-way hybrid maize; manurial and cultural experiments to determine nitrogen and P_2O_5 requirements of maize

11. Agricultural Research Station, Bail-Hongal

Address and distance from Railway Station	Bail-Hongal, District Belgaum, Mysore; 27 miles from Belgaum Railway Station
When established	1948
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	25 inches Lat. 15.55° N Long. 74.55° E Alt. 2000 feet
Soil type	Red loam and black loam
Programme of research	Selection and breeding work in *jowar*, wheat, groundnut, gram, *kulthi* and safflower; agronomic experiment in wheat, *jowar* and groundnut

12. Agricultural Research Station, Dharwar

Address and distance from Railway Station	Dharwar, Mysore; 4 miles from Dharwar Railway Station
When established	1904
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	28 inches Lat. 15.27° N Long. 76.6° E Alt. 2225 feet
Soil type	Medium black, loamy
Programme of research	Breeding and agronomical research on China-*mug*, cotton, gram, wheat, *jowar* and groundnut

13. Agricultural Research Station, Jagalbet (Sirsi)

Address and distance from Railway Station	Jagalbet, District North Kanara, Mysore; 10 miles from Gonda Railway Station
When established	1949
Whether research, multiplication or demonstration farm	Rearch-*cum*-multiplication farm
State, University or private managed	Sate manged
Annual rainfall, latitude, longitude and altitude	95 inches Lat. 15.20°N Long. 74.30°E
Soil type	Low-land clayey loam, upland loam
Programme of research	Agronomical and breeding research on paddy and fibre crops

14. Agricultural Research Station, Kaladgi

Address and distance from Railway Station	Kaladgi, District Bijapur, Mysore; 15 miles from Bagalkot Railway Station
When established	1951
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	20 inches Lat. 17°N Long. 76°E
Soil type	Clayey loam, deep black
Programme of research	Research on wheat, cotton, gram, etc.

15. Agricultural Research Station, Kumta

Address and distance from Railway Station	Kumta, District North Kanara, Myssore; 101 miles from Hubli Railway Station
When established	1948
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	150 inches Lat. 150°N Long. 74°E Alt. 202 feet
Soil type	Laterite
Programme of research	Breeding and agronomical research on paddy

16. Agricultural Research Station, Mugad

Address and distance from Railway Station	Mugad, District Dharwar, Mysore, 1½ miles from Mugad railway station
When established	1953
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	48 inches Lat. 74°N Long. 16°E Alt. 2300 feet
Soil type	Clay mixed with red, black and brown soils
Programme of research	Breeding and agronomical research on paddy

17. Agricultural Research Station, Nargund

Address and distance from Railway Station	Nargund, district Dharwar, Mysore; 25 miles from Annigeri Railway Station
When established	1946
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	22 inches Lat. 15. 40°N Long. 75.40°E Alt 2650 feet
Soil type	Alkali soils
Programme of research	Research on cotton, *jowar*, wheat and other crops

18. Agricultural Research Station, Saundatti

Address and distance from Railway Station	Saundatti, District Belgaum, Mysore ; 24 miles from Dharwar Railway Station
When established	1951
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	26 inches Lat. 15.5° N Long. 75.5° E

Soil type	Clayey loam
Programme of research	Research on *jowar*, groundnut, cotton, wheat, etc.

19. Agricultural School Farm, Devihosur

Address and distance from Railway Station	Devihosur, district Dharwar, Mysore ; 6 miles from Haveri Railway Station
When established	1947
Whether research, multiplication or demonstration farm	Research-*cum*-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	33 inches Lat. 14° N Long. 75° E
Soil type	Sandy loam and clay loam
Programme of research	Breeding and agronomical research on pulses, *jowar* and chillies

20. Grass Breeding Station, Dharwar

Address and distance from Railway Station	Dharwar, Mysore ; 3 miles from Dharwar Railway Station
When established	1950
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Programme of research	(*a*) Collection and botanical study of indigenous grasses and legumes (*b*) Introduction and acclimatisation of exotic grasses and legumes (*c*) Palatability tests and chemical analyses of grasses Pasture investigation such as balanced mixtures of grasses and legumes, effect of sulphur and other trace elements on yield of grasses, reseeding experiments, etc.

21. Nucleus Seed Scheme, Dharwar

Address and distance from Railway Station	Dharwar, Mysore ; Railway Station Dharwar
When established	1945
Whether research, multiplication or demonstration farm	Multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	28 inches Lat. 15.27° N Long. 76.6° E Alt. 2225 feet
Soil type	Medium black
Programme of research	Multiplication of wheat, *jowar*, pulses and gram seed varieties

22. Research-*cum*-Multiplication Farm, Dharwar

Address and distance from Railway Station	Dharwar, Mysore ; 3 miles from Gadag Railway Station
When established	1942
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	22 inches Lat. 15.1°5 N Long. 75° E Alt. 2131 feet
Soil type	Medium and red loam type
Programme of research	Breeding and agronomic research on cotton, *jowar*, etc.

23. Cashew Research Station, Mangalore

Address and distance from Railway Station	Mangalore, District South Kanara, Mysore ; 2 miles from Ullal Railway Station
When established	1953
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Programme of research	(1) Establishment of comprehensive collection of types of cashew, study of their performance with a view to formulating a list of types suitable for extended cultivation (2) Maintenance of progeny plots (3) Standardisation of vegetative propagational methods (4) Multiplication of progenies of promising types (5) Blossom biological studies (6) Manurial and irrigational aspects (7) Top-working trials

24. Model Orchard Centre, Mangalore

Address and distance from Railway Station	Alape village, District Mangalore, Mysore ; 4½ miles from Mangalore Railway Station
When established	1952
Whether research, multiplication or demonstration farm	Demonstration farm
State, University or private managed	State managed
Programme of research	Only a demonstration farm

25. Paddy Breeding Station, Mangalore

Address and distance from Railway Station	Mangalore, District South Kanara, Mysore ; 2½ miles from Mangalore Railway Station
When established	1944
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	138 inches Lat. 12.52° N Long. 74.52° E Alt. 150 feet
Soil type	Loam (laterite soil)
Programme of research	Varietal, cultural and manurial trials on paddy. Pulses, sweet potato, cotton and banana are also under study

26. Dairy Cultivation Section, Mercara

Address and distance from Railway Station	Mercara, Coorg, Mysore ; 78 miles from Mysore Railway Station
When established	1950
Whether research, multiplication or demonstration farm	Demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	125 inches Lat. 12° N Long. 76° E Alt. 3961 feet
Soil type	Clayey loam
Programme of research	Paddy and fodder grasses are under experiment

27. Government Agricultural Farm, Kudige

Address and distance from Railway Station	Kudige, Mysore ; 56 miles from Mysore Railway Station
Whether research, multiplication or demonstration farm	Multiplication-*cum*-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	45 inches Alt. 2600 feet

Soil type	Clayey loam and red loam
Programme of research	Manurial experiments on oats, paddy and horse gram

28. Government Agricultural Farm, Ponnampet

Address and distance from Railway Station	Ponnampet, Mysore ; 60 miles from Mysore Railway Station
When established	1951
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	100 inches Lat. 12° N Long. 76° E Alt. 300 feet
Soil type	Sandy loam
Programme of research	Mainly manurial trials on paddy. Other crops handled are babbas, soyabean, *cholam,* vegetables and root crops

29. Orange Research Station, Oddermotte

Address and distance from Railway Station	Oddermotte, Mysore ; 63 miles from Mysore Railway Station
When established	1951
Whether research, multiplication or demonstration farm	Research station
State, University or private managed	State managed
Programme of research	Root stock trials with exotic and local varieties, manurial requirements of mandarins, investigations into pests and diseases and cultural practices of orange

30. Crop Weather Observation Station, Raichur

Address and distance from Railway Station	Raichur, Mysore ; 2½ miles from Raichur Railway Station
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	24 inches Lat. 16.12° N Long. 77.12° E Alt. 1278 feet
Soil type	Red chalk and medium black cotton soil
Programme of research	Crop weather observation

31. Government Experimental Farm, Raichur

Address and distance from Railway Station	Raichur ; Mysore ; 2 miles from Raichur Railway Station
When established	1933
Whether research, multiplication or demonstration farm	Experimental farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	24 inches Lat. 16.12° N Long. 77.12° E Alt. 1278 feet
Programme of research	(1) Breeding work on cotton, pulses and *jowar* (2) Varietal tests on the above crops to find out the best variety for this tract

32. Tungabhadra Agricultural Research Station, Dhadesugur

Address and distance from Railway Station	Dhadesugur, Mysore ; 72 miles from Raichur Railway Station
When established	1943
Whether research, multiplication or demonstration farm	Research farm
Programme of research	Soil physics and plant breeding conducted with particular emphasis on *jowar,* rice, cotton and sugarcane

33. Agricultural Research Station, Annigeri

Address and distance from Railway Station	Annigeri, Dharwar District
When established	1947
Whether research, multiplication or demonstration farm	Research

State, University or private managed	State managed
Programme of research	Botanical improvement on cereals (except rice), pulses, and oilseeds. Several local bulks and ex-state collections in respect of each crop have been introduced to study the possibility of improvement either by direct introduction or by selection or through hybridisation

34. Agricultural Research Station, Alnawar

Address and distance from Railway Station	Alnawar, Dharwar District (1 mile from Alnawar Railway Station)
When established	1948
Whether research, multiplication or demonstration farm	Meant for conducting agronomic experiment on sugarcane and paddy
State, University or private managed	State managed
Programme of research	(*a*) To conduct N.P.K. trials on sugarcane suitable to the Malnad tract of Dharwar Division in different doses and ratios (*b*) To conduct varietal trials to find out suitable variety for the tract (*c*) To conduct trials of spraying of sodium salt (2, 4-D) and minor elements on sugarcane (*d*) To conduct trials of N and P on paddy and multiplication of Mugud and other varieties

35. Agricultural Research Station, Nargund

Address and distance from Railway Station	Nargund, Dharwar District, situated 26 miles away from Annigeri Railway Station
When established	1946
Whether research, multiplication or demonstration farm	Research station
State, University or private managed	State managed
Programme of research	Reclamation of alkali soils and evolving suitable cultural practices, replicated experiments—agronomic series—chemical series—field trials

36. Agricultural School Farm, Ramakrishna krishishala

Address and distance from Railway Station	Ramakrishna krishishala, Anekal Taluk, Bangalore District, 20 miles from Bangalore Railway Station
When established	1928
Whether research, multiplication or demonstration farm	Farm attached to the School for imparting practical instructions in agriculture to the students
State, University or private managed	State managed
Programme of research	The farm incidentally serves the purpose of seed multiplication

37. Basic Agricultural School Farm, Somanahalli

Address and distance from Railway Station	Somanahalli, Maddur Post,—5 miles from Maddur Railway Station
When established	1939
Whether research, multiplication or demonstration farm	Intended for practical training to Agricultural School students
State, University or private managed	Managed by Department of Agriculture
Programme of research	The Farm incidentally serves the purpose of seed multiplication

38. Agricultural Research Station, Hebbal

Address and distance from Railway Station	Hebbal, Bangalore—five miles from Bangalore Railway Station
When established	1904
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Programme of research	Research is carried on by the several sections of the College in all branches of Agricultural Science (varietal, manurial, entomological, mycological and cultural)

39. Agricultural College Farm, Dharwar

Address and distance from Railway Station	Dharwar, 6 miles from Dharwar Railway Station
When established	1947
Whether research, multiplication or demonstration farm	Farm mainly meant for teaching purpose. Research and multiplication works are also undertaken on the farm
State, University or private managed	State managed
Programme of research	Agronomic experiments

40. Agricultural Research Station, Bijapur

Address and distance from Railway Station	Bijapur, 6 miles from Bijapur Railway Station and 4 miles and 6 furlongs from Bijapur City
When established	1933
Whether research, multiplication or demonistration farm	The main object of the farm is to conduct research on breeding of crops. Multiplication of nucleus seed of the improved strains is also done
State, University or private managed	State managed
Programme of research	Breeding work has been undertaken for the improvement of various *kharif* and *rabi* crops viz. *bajra*, groundnut, *mung* and *tur* in *kharif* and *jowar*, wheat, gram, safflower and lineseed an *rabi*.

ORISSA

AGRICULTURAL RESEARCH STATIONS

1. Kujang Farm, Kujang

Address and distance from Railway Station	Kujang, District Cuttack, Orissa ; 49 miles from Cuttack Railway Station
When established	1928
Whether research, multiplication or demonstration farm	Multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	60 inches Lat. 31°N Long. 19°E Alt. 20 feet
Soil type	Clayey loam
Programme of research	Manurial, verietal and cultural research on paddy, wheat, pulses, sugarcane, jute and vegetables

2. Jajpur Farm, Jajpur

Address and distance from Railway Station	Jajpur, District Cuttack, Orissa ; 18 miles from Jajpur-Keonjhar Road Station
When established	1946
Whether research, multiplication or demonstration farm	Multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	71 inches Lat. 20.50°N Long. 86.20°E
Soil type	Clayey loam
Programme of research	Multiplication of paddy and *mung* seed varieties

3. Athgarh Farm, Raj Athgarh

Address and distance from Railway Station	Raj Athgarh, District Cuttack, Orissa ; 9 miles from Raj-Athgarh Railway Station
When established	1952
Whether research, multiplication or demonstration farm	Multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	58 inches Lat. 20.32°N Long. 85.45°E
Soil type	Clayey loam and sandy loam
Programme of research	Breeding and research on paddy and pulse crops

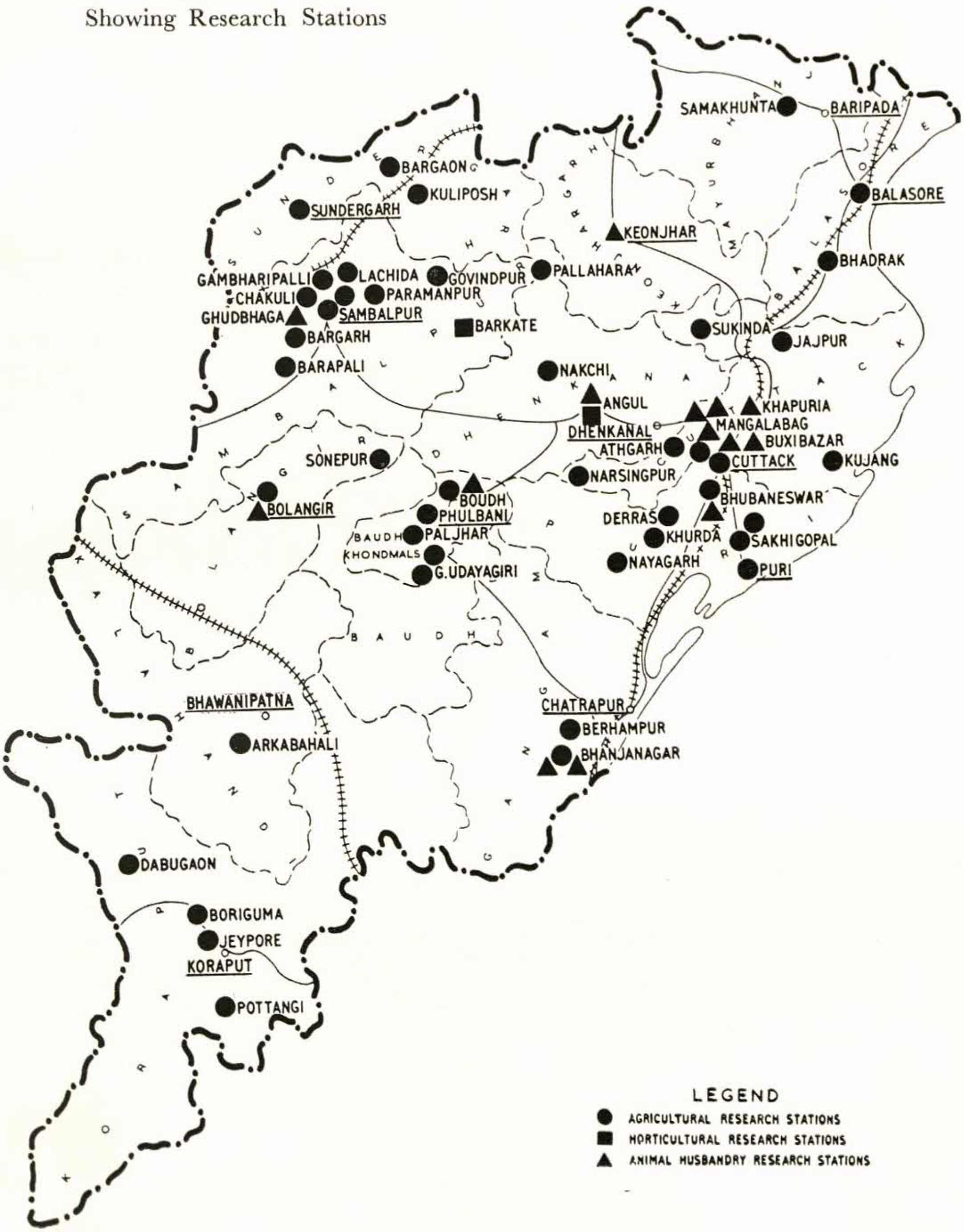
4. Sukinda Farm, Sukinda

Address and distance from Railway Station	Sukinda, District Cuttack, Orissa ; 22 miles from Jajpur-Keonhar Road Railway Station
When established	1948
Whether research, multiplication or demonstration farm	Multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	60 inches Lat. 20.58° N Long. 85.95° E
Soil type	Red laterite soils
Programme of research	Manurial trials and research on paddy, cotton, vegetables, pulses, maize, jute, groundnut, *jowar*, *dhanicha* and *mung* varieties

5. Narsingpur Farm, Narsingpur

Address and distance from Railway Station	Narsingpur, District Cuttack, Orissa ; 51 miles from Raj-Athgarh Railway Station
Whether research, multiplication or demonstration farm	Seed multiplication farm
State, University or private managed	State managed

Map of ORISSA
Showing Research Stations



Annual rainfall, latitude, longitude and altitude	54.01 inches Lat. 20.50° N Long. 85° E
Soil type	Sandy loam
Programme of research	Seed multiplication

6. Coconut Nursery, Cuttack

Address and distance from Railway Station	Cuttack, Orissa ; 3 miles from Cuttack Railway Station
When established	1946
Whether research, multiplication or demonstration farm	Coconut nursery
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	58 inches Lat. 20.28° N Long. 85.56 E Alt. 77 feet
Soil type	Clayey and clayey loam of alluvial origin
Programme of research	Raising of quality coconut seedlings for supply to coconut growers

7. Khurda Farm, Khurda

Address and distance from Railway Station	Khurda, District Puri, Orissa ; 8 miles from Khurda Road Railway Station
When established	1919
Whether research, multiplication or demonstration farm	Experimental-*cum*-seed-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	54 inches Lat. 20 2° N Long. 85.5° E Alt. 138 feet
Soil type	Clayey loam and clayey
Programme of research	Agronomic research on paddy, sugarcane and vegetables

8. Puri farm, Puri

Address and distance from Railway station	Puri, Orissa ; 4 miles from Puri Railway Station
When established	1925
Whether research, multiplication or demonstration farm	Experimental-*cum*-seed multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	49 inches Lat. 20° N Long. 86° E Alt. 4 feet
Soil type	Pure white sand
Programme of research	Research on fruits and vegetables

9. Sakhigopal farm, Sakhigopal

Address and distance from Railway Station	Sakhigopal, District Puri, Orissa ; 2 miles from Sakhigopal Railway Station
When established	1952
Whether research, multiplication or demonstration farm	Experimental-*cum*-seed multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	60.59 inches Lat. 20° N Long. 86° E Alt. 20 feet
Soil type	Loam and sandy loam
Programme of research	Seed multiplications of paddy and sugarcane

10. Derras Farm, Derras

Address and distance from Railway Station	Derras, District Puri, Orissa ; 12 miles from Khurda Road Railway Station

When established	1951
Whether research, multiplication or demonstration farm	Experimental-*cum*-seed multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	61 inches
	Lat. 20.15° N
	Long. 85.50° E
	Alt. 138 feet
Soil type	Loam and clay cloam
Programme of research	Seed multiplication of paddy and sugarcane varieties

11. Nayagarh farm, Nayagarh

Address and distance from Railway Station	Nayagarh, District Puri, Orissa ; 50 miles from Khurda Road Railway Station
Whether research, multiplication or demonstration farm	Experimental-*cum*-seed multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	52.30 inches
	Lat. 20.20° N
	Long. 85.20° E
Soil type	Loam and clayey loam
Programme of research	Seed multiplication of sugarcane and paddy varieties

12. State Research Station, Bhubaneswar

Address and distance from Railway Station	Bhubaneswar, District Puri, Orissa; 4 miles from Bhubaneswar Railway Station
When established	1949
Whether research, multiplication or demonstration farm	Seed multiplication-*cum*-research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	55 inches
	Lat. 20.20°N
	Long. 86.10°E
	Alt. 85 feet
Soil type	Sandy loam and loam
Programme of research	Seed multiplication of paddy, pulses, sugarcane, vegetables and fruits seed varieties

13. Regional Coconut Research Station, Sakhigopal

Address and distance from Railway Station	Sakhigopal, District Puri, Orissa; 5 miles from Sakhigopal Railway Station
When established	1955
Whether research, multiplication or demonstration farm	Research station
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	55 inches
	Lat. 19.52°N
	Long. 85.20°E
	Alt. 20 feet
Soil type	Loamy soil with high water table
Programme of research	Raising fresh coconut plantation to conduct studies and experiments on cultural and manurial aspects of coconut cultivation. Study of performance of exotic varieties of coconut plam and raising of quality seedling for supply to cultivators

14. Balia Farm, Balasore

Address and distance from Railway Station	Balasore, Orissa ; 4 miles from Balasore Railway Station
When established	1942
Whether research, multiplication or demonstration farm	Experimental-*cum*-seed multiplication farm
Annual rainfall, latitude, longitude and altitude	62.04 inches
	Lat. 21.50°N
	Long. 87°E

Soil type	Loam and sandy loam
Programme of research	Seed multiplication of paddy and sugarcane varieties and agronomic trials

15. Bhadrak Farm, Bhadrak

Address and distance from Railway Station	Bhadrak, District Balasore, Orissa; 4 miles from Bhadrak Railway Station
Whether research, multiplication or demonstration farm	Experimental *cum*-seed multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	56 inches Lat. 21.5°N Long. 86.30°E
Soil type	Clayey and clayey loam
Programme of research	Multiplication of paddy and *mung* seed varieties

16. Bhanjanagar Farm, Ganjam

Address and distance from Railway Station	Bhanjanagar, District Ganjam, Orissa; 50 miles from Berhampur Railway Station
Whether research, multiplication or demonstration farm	Experimental-*cum*-seed multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	61 inches Lat. 19.57°N Long. 84.36°E
Soil type	Sandy loam and clayey loam
Programme of research	Seed multiplication of paddy, groundnut and sugarcane varieties

17. Rice Research Substation, Berhampur

Address and distance from Railway Station	Berhampur, District Ganjam, Orissa; 6 miles from Berhampur Railway Station
When established	1932
Whether research, multiplication or demonstration farm	Experimental farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	50 inches Lat. 19.50°N Long. 84.30°E
Soil type	Red soils and clay soils
Programme of research	Agronomical research on paddy varieties

18. Dabugaon Farm, Dabugaon

Address and distance from Railway Station	Dabugaon, District Koraput, Orissa; 126 miles from Rayagada Railway Station
When established	1948
Whether research, multiplication or demonstration farm	Experimental-*cum*-seed multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	55–60 inches Lat. 19.5°N Long. 82.5°E Alt. 1700 feet
Soil type	Sandy loam
Programme of research	Multiplication of paddy, sugarcane, groundnut, wheat, pulses and vegetable varieties

19. Pottangi Farm, Pottangi

Address and distance from Railway Station	Pottangi, District Koraput, Orissa; 35 miles from Bobili Railway Station
When established	1938
Whether research, multiplication or demonstration farm	Experimental-*cum*-seed multiplication farm
State, University or private managed	State managed

Annual rainfall, latitude, longitude and altitude	80 inches Alt. 3200 feet Lat. 18.5°E Long. 83°E
Soil type	Red loam
Programme of research	Breeding and agronomical research on orange, peach, plum, pine apple and papaya

20. Boriguma Farm, Boriguma

Address and distance from Railway Station	Boriguma, District Koraput, Orissa; 90 miles from Bobili Railway Station
Whether research, multiplication or demonstration farm	Experimental-cum-seed multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude longitude and altitude	61 inches Lat. 19.3°N Long. 82.34°E Alt. 2000 feet
Soil type	Loam and clayey loam
Programme of research	Multiplication of paddy and *mung* seed varieties

21. Rice Research Substation, Jeypore

Address and distance from Railway Station	Jeypore, District Koraput, Orissa; 105 miles from Viziyanagaram Railway Station
When established	1937
Whether research, multiplication or demonstration farm	Research station
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	70 inches Alt. 2500 feet Lat. 18.20°E Long. 82·5°
Soil type	Laterite and clayey soils
Programme of research	Agronomical research on paddy

22. Samakhunta Farm, Samakhunta

Address and distance from Railway Station	Samakhunta, District Mayurbhanj, Orissa ; 4 miles from Baripada Railway Station
When established	1935
Whether research, multiplication or demonstration farm	Seed multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	56 inches Lat. 21.56°N Long. 86.46°E Alt. 259 feet
Soil type	Clayey loam
Programme of research	Multiplication of paddy seed and sugarcane varieties

23. Citrus Fruit Research Station, Angul

Address and distance from Railway Station	Angul, District Dhenkanal, Orissa ; 15 miles from Meramundali Railway Station
When established	1947
Whether research, multiplication or demonstration farm.	Research station
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	50.73 inches Lat. 21°N Long. 85.2°E
Soil type	Red loam.
Programme of research	Breeding and agronomical research on citrus fruits

24. Pallahara Farm, Pallahara

Address and distance from Railway Station	Pallahara, District Dhenkanal, Orissa ; 50 miles from Talcher Railway Station
Whether research, multiplication or demonstration farm	Experimental-*cum*-seed multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	55 inches Lat. 21.50°N Long. 85°E Alt. 450 feet
Soil type	Clayey loam
Programme of research	Seed multiplication and agronomic trials

25. Nakchi farm, Nakchi

Address and distance from Railway Station	Nakchi, District Dhenkanal, Orissa ; 59 miles from Meramundali Railway Station
Whether research, multiplication or demonstration farm	Experimental-*cum*-seed multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	55 inches Lat. 21°N Long. 84.80°E Alt. 672 feet
Soil type	Sandy loam
Programme of research	Seed multiplication and agronomic trials to increase yield

26. Sambalpur Farm, Sambalpur

Address and distance from Railway Station	Sambalpur, Orissa ; ½ mile from Sambalpur Railway Station
Whether research, multiplication or demonstration farm.	Experimental-*cum*-seed multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	55 inches Lat. 21.50°N Long. 84°E Alt. 586 feet
Soil type	Sandy loam to clay
Programme of research	The farm chiefly concerns itself with multiplication of seeds

27. Bargarh Farm, Bargarh

Address and distance from Railway Station	Bargarh, District Sambalpur, Orissa ; 40 miles from Sambalpur Railway Station
Whether research, multiplication or demonstration farm	Experimental-*cum*-seed multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	70 inches Lat. 21.21°N Long. 83.37°E
Soil type	Loam and sandy loam
Programme of research	Research on paddy and multiplication of the varieties

28. Govindpur farm, Govindpur

Address and distance from Railway Station	Govindpur, District Sambalpur, Orissa ; situated just near Bamara Railway Station
Whether research, multiplication or demonstration farm	For sisal cultivation
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	55 inches Lat. 22.25°N Long, 84.5°E
Soil type	Sandy loam
Programme of research	To conduct trials to increase yields of sisal

29. Barapali farm, Barapali

Address and distance from Railway Station	Barapali, District Sambalpur, Orissa ; 50 miles from Sambalpur Railway Station

When established	1948
Whether research, multiplication or demonstration farm	Experimental-*cum*-seed multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	70 inches Lat. 21.13°N Long. 83.36°E
Soil type	All types of soil available
Programme of research	Multiplication of paddy, *mung* and *khesari* seed varieties and varietal trials on wheat, sugarcane, potato, groundnut, *dhaincha*, etc.

30. Barkate Nursery, Barkate

Address and distance from Railway Station	Barkate, District Sambalpur, Orissa ; 85 miles from Bamara Railway Station
Whether research, multiplication or demonstration farm	Fruit nursery
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	55 inches Lat. 21.5°N Long. 85°E
Soil type	Sandy loam
Programme of research	Raising of quality seedlings of the indigenous fruits

31. Paramanpur Farm, Paramanpur

Address and distance from Railway Station	Paramanpur, District Sambalpur, Orissa ; 25 miles from Sambalpur Railway Station
When established	1956
Whether research, multiplication or demonstration farm	Demonstration and seed multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	55 inches Lat. 21.5°N Long. 84°E
Soil type	Sandy loam
Programme of research	Seed multiplication

32. Lachida farm, Lachida

Address and distance from Railway Station	Lachida, District Sambalpur, Orissa ; 32 miles from Sambalpur Railway Station
When established	1956
Whether research, multiplication or demonstration farm	Demonstration and multiplication of cotton and sugarcane
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	55 inches Lat. 21.5° N Long. 84° E
Soil type	Loam and sandy loam
Programme of Research	Multiplication of cotton and sugarcane seeds

33. Gambharipalli Farm, Gambharipalli

Address and distance from Railway Station	Gambharipalli, District Sambalpur, Orissa ; 22 miles from Sambalpur Railway Station
When established	1956
Whether research, multiplication or demonstration farm	Demonstration and seed multiplication and horticultural farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	55 inches Lat. 21.5° N Long. 84° E
Soil type	Sandy loam
Programme of research	Trials in horticulture and multiplication of seeds

34. Chakuli Farm, Chakuli

Address and distance from Railway Station	Chakuli, District Sambalpur, Orissa ; 20 miles from Sambalpur Railway Station
When established	1956
Whether research, multiplication or demonstration farm	Cotton Research and cotton seed multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	55 inches Lat. 21.5° N Long. 84° E
Soil type	Sandy loam
Programme of research	Agronom cal research and multiplication of cotton seed varieties

35. Agricultural Research Station, Sambalpur

Address and distance from Railway Station	Sambalpur, Orissa ; ½ mile from Sambalpur Railway Station
When established	1954
Whether research, multiplication or demonstration farm	Research Station
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	55 inches Lat. 21.50° N Alt. 586 feet Long. 84° E
Soil type	Sandy loam to clay
Programme of research	Agronomical research on paddy, pulses, sugarcane, vegetable and fruit seed varieties

36. Rajendra Farm, Bolangir

Address and distance from Railway Station	Bolangir, District Bolangir, Orissa ; 45 miles from Titlagarh Railway Station
Whether research, multiplication or demonstration farm	Experimental-*cum*-seed farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	57.54 inches Lat. 20.8° N Long. 83.5° E
Soil type	Loam to clayey loam
Programme of research	Multiplication of paddy and groundnut varieties

37. Sonepur Farm, Sonepur

Address and distance from Railway Station	Sonepur, District Bolangir, Orissa ; 75 miles from Titlagarh Railway Station
Whether research, multiplication or demonstration farm	Experimental-*cum*-seed multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	50 inches Lat. 20.50° N Long. 83.53 E
Soil type	Loam and clayey loam
Programme of research	Multiplication of paddy, groundnut and *dhaincha* seed varieties

38. Arkabahali farm, Arkabahali

Address and distance from Railway Station	Arkabahali, District Kalahandi, Orissa ; 21 miles from Kesinga Railway Station
Whether research, multiplication or demonstration farm	Experimental-*cum*-seed multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	50 inches Lat. 20.50° N Long. 82.53° E
Soil type	Loam to clayey loam
Programme of research	Agronomic experiments and seed multiplication

39. Sundergarh Farm, Sundergarh

Address and distance from Railway Station	Sundergarh, Orissa ; 21 miles from Jharsuguda Railway Station
When established	1952
Whether research, multiplication or demonstration farm	Experimental-*cum*-seed multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	62.50 inches Lat. 22° N Long. 84° E Alt. 1000 feet
Soil type	Sandy loam to clayey loam
Programme of research	Multiplication of paddy seeds

40. Bargaon Farm, Bargaon

Address and distance from Railway Station	Bargaon, District Sundergarh, Orissa ; 20 miles from Rajgangpur Railway Station
When established	1943
Whether research, multiplication or demonstration farm	Experimental-*cum*-seed multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	57.50 inches Lat. 20° N Long. 84.25 E Alt. 1000 feet
Soil type	Sandy loam
Programme of research	Agronomic experiments and seed multiplication

41. Kuliposh Farm, Kuliposh

Address and distance from Railway Station	Kuliposh, District Sundergarh, Orissa ; 51 miles from Rourkella Railway Station
Whether research, multiplication or demonstration farm	Experimental and seed farm and graft nursery
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	62.50 inches Lat. 21.75° N Long. 85° E Alt. 1000 feet
Programme of research	Seed multiplication and graft nursery

42. Boudh Farm, Boudh

Address and distance from Railway Station	Boudh, District Boudh-Phulbani, Orissa ; 150 miles from Berhampur Railway Station
Whether research, multiplication or demonstration farm	Experimental and seed farm and graft nursery
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	57.72 inches Lat. 20.8° N Long. 84.2° E
Soil type	Loam to clayey loam
Programme of research	Seed multiplication and graft nursery

43. G. Udayagiri Farm, G. Udayagiri

Address and distance from Railway Station	G. Udayagiri, District Boudh-Phulbani, Orissa ; 79 miles from Berhampur Railway Station
When established	1937
Whether research, multiplication or demonstration farm	Experimental and seed farm and graft nursery
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	60 inches Lat. 20.8° N Long. 84.22° E Alt. 2112 feet
	Clayey loam and sandy loam
Programme of research	Seed multiplication and graft nursery

44. Phulbani Farm, Phulbani

Address and distance from Railway Station	Phulbani, District Boudh Phulbani, Orissa ; 107 miles from Berhampur Railway Station
Whether research, multiplication or demonstration farm	Experimental and seed farm and graft nursery
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	50 inches Lat. 20.5° N Long. 84.2° E Alt. 1500 feet
Soil type	Loam to sandy loam
Programme of research	Seed multiplication and graft nursery

45. Turmeric Research Station, G. Udayagiri

Address and distance from Railway Station	G. Udayagiri, District Boudh Phulbani, Orissa; 78 miles from Berhampur Railway Station
When established	1943
Whether research, multiplication or demonstration farm	Research station
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	60 inches Lat. 20. 8° N Long. 84.22° E Alt. 2535 feet
Soil type	Clayey loam and sandy loam
Programme of research	Agronomical research on turmeric, mustard, niger, *jowar*, paddy and vegetables

46. Paljhar Farm, Paljhar

Address and distance from Railway Station	Paljhar, District Phulbani, Orissa; 162 miles from Berhampur Railway Station
Whether research, multiplication or demonstration farm	Seed multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	57.72 inches Lat. 21° N Long. 84.4° E
Soil type	Loam to clayey loam
Programme of research	Seed multiplication.

ORISSA

ANIMAL HUSBANDRY RESEARCH STATIONS

1. Orissa Serum Institute, Mangalabag

Address and distance from Railway Station	Mangalabag, Orissa ; one mile from Cuttack Railway Station
When established	1946
State, University or private managed	State managed
Programme of research	The activities of the Institute are restricted to the production of veterinary biologicals for the control and eradication of animal epizootics, vaccines to control rinderpest, haemorrhagic septicaemia and black quarter and Ranikhet disease

2. State Livestock Breeding Farm, Khapuria

Address and distance from Railway Station	Khapuria, District Cuttack, Orissa, 6 miles from Cuttack Railway Station
When established	1957
State, University or private managed	State managed
Programme of research	Research on breeding problems

3. Provincial Veterinary Laboratory, Mangalabag

Address and distance from Railway Station	Mangalabag, Orissa ; one mile from Cuttack Railway Station
When established	1921
State, University or private managed	State managed
Programme of research	Studies on contagious caprine pleuro-pneumonia, control of fascioliasis and amphistomiasis in sheep and goats. Stephanofilariasis, Ranikhet disease and avian lucosis complex. Brucellosis and diseases caused by acid-fast organism and other problems presented by field staff Researches on feeds which are running to waste in the State such as *Cassiatora* plant, meat and blood meals Study on the causes of delayed maturity in Indian bulls

4. Veterinary Dispensary, Bhubaneswar

Address and distance from Railway Station	New capital Bhubaneswar, Puri District Orissa; 2 miles from Bhubaneswar Railway Station
When established	1955
State, University or private managed	State and I.C.A.R. managed on 50:50 basis
Programme of research	Research on lumber paralysis in Beetal goats

5. Veterinary Dispensary, Cuttack

Address and distance from Railway Station	Buxibazar, Cuttack, Orissa; 2 miles from Cuttack Railway Station
When established	1955
State, University or private managed	State and I.C.A.R. managed on 50:50 basis
Programme of research	Research on retention of placenta in bovines

6. District Livestock Breeding Farm— (1) Bhanjanagar
(2) Bolangir

Address and distance from Railway Station	(1) Bhanjanagar, Ganjam, Orissa 55 miles from Berhampur Railway Station (2) Bolangir, Orissa 42 miles from Titlagarh Railway Station
When established	(1) 1950 (2) 1955
State, University or private managed	1 and 2 State and I.C.A.R. managed on 50:50 basis
Programme of research	Research on upgrading of indigenous cattle of (1) Ghumsur type (2) Khariar type

7. District Livestock Breeding Farm— (1) Keonjhar
(2) Boudh
(3) Village Centre Gamundi in Bhanjanagar
(4) Ghudibhaga

Address and distance from Railway Station	(1) Keonjhar, Orissa, 72 miles from Jajpur Road Station (2) Boudh, Phulbani District, Orissa; 146 miles from Berhampur Railway Station (3) Gamundi, Bhanjanagar, Ganjam, Orissa; 52 miles from Berhampur (4) Ghudibhaga, Sambalpur, Orissa 25 miles from Sambalpur
When established	1954
State, University or private managed	State and I.C.A.R. managed on 50:50 basis
Programme of research	Research on utilisation of waste products as cattle feed

8. Poultry Breeding Farm, Angul

Address and distance from Railway Station	Angul, Dhenkanal, Orissa
When established	1951
State, University or private managed	State managed
Programme of research	Research on poultry breeding

9. Veterinary College, Orissa

Address and distance from Railway Station	Mangalabag, Cuttack District, Orissa
When established	1955
State, University or private managed	State managed
Programme of research	Research in veterinary subjects

10. Regional Artificial Insemination Centre, Buxibazar

Address and distance from Railway Station	Buxibazar, Orissa, 3 miles from Cuttack Railway Station
When established	1955
State, University or private managed	State managed
Programme of research	Study on the sexual behaviour of bulls and evaluation and morphology of semen.

PUNJAB

AGRICULTURAL RESEARCH STATIONS

1. Agricultural Farm, Karnal

Address and distance from Railway Station	Karnal, Punjab; 3 miles from Karnal Railway Station
When established	1929
Whether research, multiplication or demonstration farm	Demonstration farm
State, University or private managed	State managed
Annual rainfall	30 inches
Soil type	Clay loam
Programme of research	Research on agronomical aspects of sugarcane, cotton, barley and wheat

2. Agricultural Research Station, Ferozepur Cantt.

Address and distance from Railway Station	Ferozepur, Punjab; 3½ miles from Ferozepur Cantt. Railway Station
When established	1927
Whether research, multiplication or demonstration farm	Research-*cum*-seed multiplication farm
State, University or private managed	State managed
Annual rainfall	18 inches
Soil type	Varies from clay loam to sandy loam
Programme of research	Agronomical and botanical research on gram, *bajra* and tobacco

3. Agricultural Station, Gurdaspur

Address and distance from Railway Station	Gurdaspur, Punjab; ½ mile from Gurdaspur Railway Station
When established	1910
Whether research, multiplication or demonstration farm	Research-*cum*-seed farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	38 inches Lat. 32.03° N Long. 75.03° N Alt. 875 feet above sea level
Soil type	Loam to sandy loam
Programme of research	Breeding and agronomical research on barley, wheat, maize, cotton, sugarcane, etc.

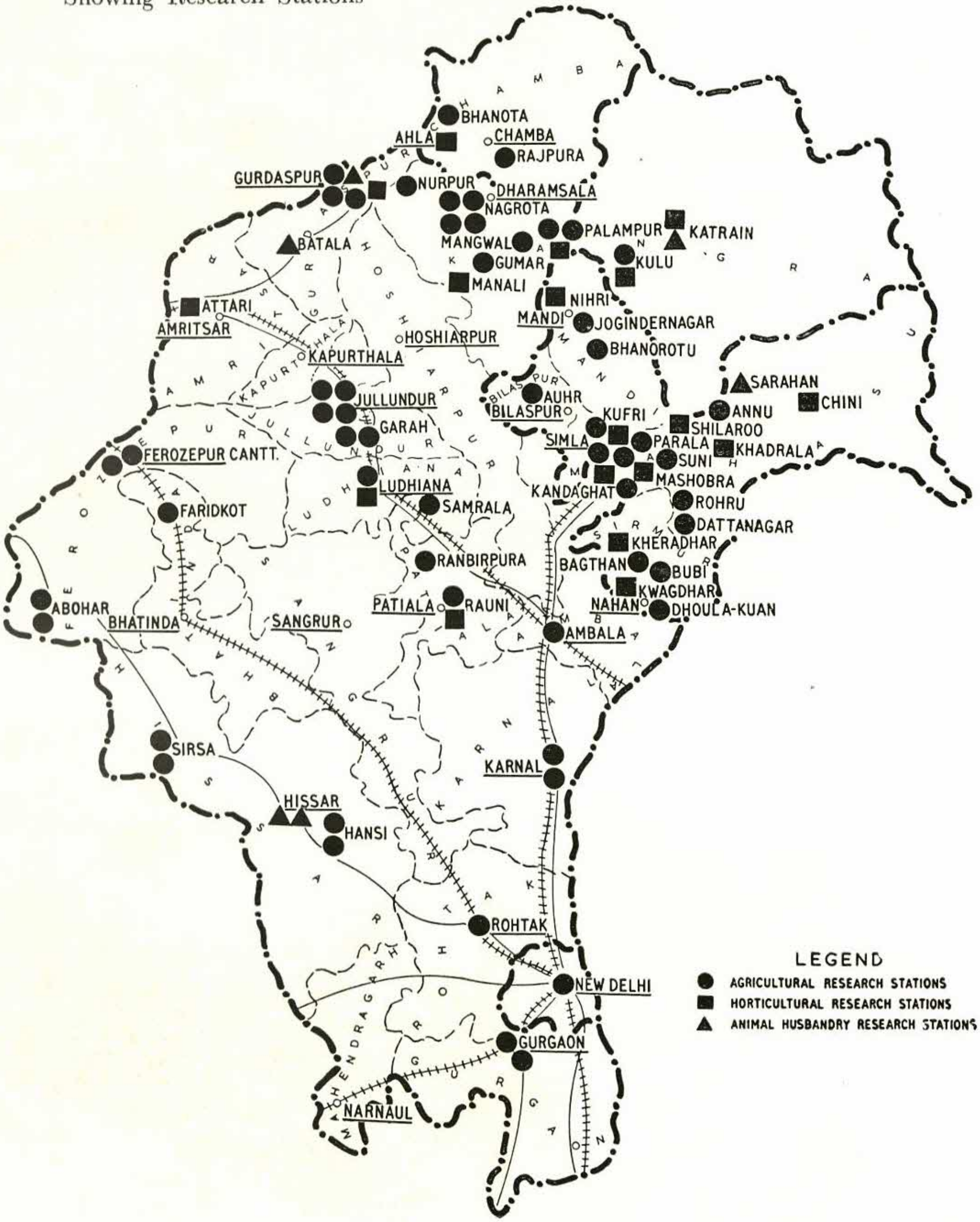
4. Agricultural Station, Hansi

Address and distance from Railway Station	Hansi, District Hissar Punjab; 4½ miles from Hansi Railway Station
When established	1914
Whether research, multiplication or demonstration farm	Research-*cum*-seed multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	16.68 inches Lat. 29.07° N Long. 75.80° E Alt. 711.17 feet
Soil type	Loam and clayey loam
Programme of research	Experimental research on crops as wheat, cotton, sugarcane, *methi*, lucerne, barley, berseem, oats,lentil and fruits, viz. citrus, mangoes, *ber*, guavas and pomegranates. Propagation of fruit plants for sale to public

5. Agricultural Station, Jullundur

Address and distance from Railway Station	Jullundur, Punjab; ½ mile from Jullundur Railway Station
When established	1928
Whether research, multiplication or demonstration farm	Research and demonstration farm
State, University or private managed	State managed
Annual rainfall	28 inches
Soil type	Loam, sandy loam and sandy

Map of
PUNJAB & HIMACHAL PRADESH
Showing Research Stations



Programme of research	Agronomical research on major crops of the tract, viz. wheat, cotton, sugarcane, maize, groundnut, potato, etc.

6. Agricultural Station, Ambala

Address and distance from Railway Station	Ambala, Punjab; ½ mile from Ambala City Railway Station
When established	1945
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall	28 inches
Soil type	Clayey loam
Programme of research	Agronomical research on sugarcane, wheat, cotton, maize, gram, oats, barley, *jowar* and mash

7. Barley Research Farm, Gurgaon

Address and distance from Railway Station	Gurgaon, Punjab; 3½ miles from Gurgaon Railway Station
When established	1940
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall	25 inches
Soil type	Sandy loam
Programme of research	Research on barley, wheat, cotton, *bajra*, *jowar*, Brassica, gram, *mung* and tobacco

8. Cereal Breeding Station, Garha

Address and distance from Railway Station	Garha, District Jullundur, Punjab; 2½ miles from Jullundur City Railway Station
When established	1948
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall	26 inches
Soil type	Sandy loam
Programme of research	Research on agricultural crops, viz. wheat, barley, cotton, maize, pulses and other crops

9. Cereal Breeding Substation, Nagrota

Address and distance from Railway Station	Nagrota, District Kangra, Punjab ; 118 miles from Nagrota Bagwar Railway Station
When established	1945
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall	45 inches
Soil type	Clayey loam
Programme of research	Research on agricultural crops, viz., wheat, barley, maize, mash, rice, *mung*, etc.

10. Cotton Breeding Substation, Hansi

Address and distance from Railway Station	Hansi, District Hissar, Punjab; 4½ miles from Hansi Railway Station
When established	1941
Whether research, multiplication or demonstration farm	Research substation
State, University or private managed	State managed
Annual rainfall	15 inches
Soil type	Loam to clayey loam
Programme of research	Breeding and agronomical research on cotton, wheat and *Sorghum*

11. Cotton Research Station, Abohar

Address and distance from Railway Station	Abohar, District Ferozepur, Punjab, Railway Station Abohar
When established	1949

Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall	10 inches
Soil type	Sandy loam to loam
Programme of research	Breeding and agronomical research on gram and cotton

12. Cotton Research Substation, Garha

Address and distance from Railway Station	Garha Farm, Jullundur City, Punjab; 2½ miles from Jullundur City Railway Station
When established	1948
Whether research, multiplication or demonstration farm	Research station
State, University or private managed	State managed
Annual rainfall	26 inches
Soil type	Sandy loam
Programme of research	Research aiming at evolution of American cottons and wheat suitable for introduction in submontane districts of the Punjab

13. Demonstration-*cum*-Seed Multiplication Farm, Gumar

Address and distance from Railway Station	District Farm, Gumar, District Kangra, Punjab; 9 miles from Jowala Mukhi Road Railway Station
When established	1940
Whether research, multiplication or demonstration farm	Demonstration-*cum*-seed multiplication farm
State, University or private managed	State managed
Annual rainfall	69 inches
Soil type	Clayey loam
Programme of research	Experimental research on wheat, oilseeds, sugarcane, paddy, maize, soyabean and gram

14. Experimental Fruit Farm, Palampur

Address and distance from Railway Station	Palampur, District Kangra, Punjab; 14 miles from Nagrota Railway Station
When established	1951
Whether research, multiplication or demonstration farm	Research-*cum*-demonstration-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall	111 inches
Soil type	Clayey
Programme of research	Agronomical research on fruit crops, viz. apple, apricot, pear, walnut, citrus, chestnut, plum, persimmon, almond, quince, etc.

15. Fodder Research Station, Sirsa

Address and distance from Railway Station	Sirsa, District Hissar, Punjab; Railway Station Sirsa
When established	1934
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall	12 inches
Soil type	Loam to medium loam
Programme of research	Research on *jowar*, sudan grass, *moth*, *guara*, teosinte, berseem, oats, *senji*, *Sorghum*, lucerne, fieldpeas, *metha* and grasses, viz. napier, guinea and anjan grasses

16. Foundation Seed Farm, Abohar

Address and distance from Railway Station	Abohar, District Ferozepur, Punjab; Railway Station Abohar
When established	1948
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall	10 inches
Soil type	Sandy loam to loam
Programme of research	Breeding, varietal and manurial experiments on cotton, wheat, gram, *bajra*, *mash*, *guara* and rape

17. Government Agricultural College, Ludhiana

Address and distance from Railway Station	Ludhiana, Punjab; 1 mile from Ludhiana Railway Station
When established	1949
Whether research, multiplication or demonstration farm	Students Farm, attached to the Government Agricultural College, Ludhiana
State, University or private managed	State managed
Programme of research	Research on entomological and other problems connected with the studies of the students

18. Government Tea Farm, Palampur

Address and distance from Railway Station	Palampur, District Kangra, Punjab; 3 miles from Morinda Railway Station
When established	1938
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	100 inches Alt. 4000 feet above sea level
Soil type	Red clayey
Programme of research	Experiments on manuring, pruning, etc. of tea crop

19. Government Fruit Experimental Station, Attari

Address and distance from Railway Station	Attari, District Amritsar, Punjab, 1½ miles from Attari Railway Station
When established	1939
Whether research, multiplication or demonstration farm	Research-*cum*-demonstration-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall	22 inches
Soil type	Clayey loam
Programme of research	Research on all fruit crops, viz. mangoes, citrus, grapes, maltas, oranges, etc.

20. Government Garden, Gurdaspur

Address and distance from Railway Station	Gurdaspur, Punjab; Railway Station Gurdaspur
When established	1920
Whether research, multiplication or demonstration farm	Demonstration-*cum*-research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall	38 inches
Soil type	Clay loam
Programme of research	Agronomical research on fruits, viz. grapes, mangoes, pear, lichi, loquat, banana, falsa, guava, etc.

21. Hill Grasses Research Substation, Palampur

Address and distance from Railway Station	Palampur, District Kangra, Punjab; 3 miles from Palampur Railway Station
When established	1951
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall	110 inches
Soil type	Medium loamy on hill sides
Programme of research	In addition to breeding and agronomical research on pasture grasses and legumes, growth of fodder crops like berseem, oats and lucerne in *rabi* and of cultivated grasses like napier, guinea and *kudzu* vine in *kharif* is observed

22. Horticultural Research Station, Kulu

Address and distance from Railway Station	Kulu, District Kangra, Punjab; 116 miles from Nagrota Railway Station
When established	1950
Whether research, multiplication or demonstration farm	Research-*cum*-demonstration-*cum*-multiplication farm
State, University or private managed	State managed

Annual rainfall, latitude, longitude and altitude	40 inches
Soil type	Clayey loam with stones and boulders in the soil and sub-soil
Programme of research	Research on apple, cherry, peach, plum, apricot, pear and persimmon fruits

23. Linseed Breeding Substation, Mangwal

Address and distance from Railway Station	Mangwal, District Kangra, Punjab; 1/4 mile from Mangwal Railway Station
When established	1950
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall	70 inches
Soil type	Clayey loam
Programme of research	Breeding research on sesamum, maize, wheat and linseed

24. Linseed Breeding Substation, Nagrota

Address and distance from Railway Station	Nagrota, District Kangra, Punjab; ½ mile from Nagrota Railway Station
When established	1945.
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall	100 inches
Soil type	Clayey loam
Programme of research	Breeding and study of the agronomical aspects of linseed, wheat and soyabean improvement

25. Maize Breeding Station, Jullundur

Address and distance from Railway Station	Jullundur City, Punjab; 2½ miles from Jullundur City Railway Station
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall	26 inches
Soil type	Sandy loam
Programme of research	Botanical and agronomical research on maize, wheat and cotton

26. Oilseed Substation, Nagrota

Address and distance from Railway Station	Nagrota, District Kangra, Punjab; 1 mile from Nagrota Railway Station
When established	1945
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall	100 inches
Soil type	Clayey loam
Programme of research	Research on linseed and soyabean

27. Potato Plot (Research Farm) Manali

Address and distance from Railway Station	Manali, District Kangra, Punjab, 140 miles from Nagrota Railway Station
When established	1944
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and atitude	60 inches Lat. 32.15° N Long. 75.15° E Alt. 6000 feet
Soil type	Loam to clay loam
Programme of research	Agronomical research on potato

28. Regional Bee Research Station, Katrain

Address and distance from Railway Station	Katrain P.O. (Kulu), District Kangra; 129 miles from Nagrota Railway Station

When established	1951
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Programme of research	Various aspect of honey-bee management.

29. Rice Breeding Station, Gurdaspur

Address and distance from Railway Station	Gurdaspur, Punjab; 1 furlong from Gurdaspur Railway Station
When established	1950
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	33 inches Lat. 75.25° N Long. 32.03° E Alt. 875 feet
Soil type	Sandy loam to loam
Programme of research	Breeding and agronomical research on paddy, wheat and gram grown from seed multiplication only

30. Rice Breeding Substation, Nagrota

Address and distance from Railway Station	Nagrota, District Kangra, Punjab; 1 mile from Nagrota Railway Station
When established	1936
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication Farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	100 inches Lat. 32·1° N Long. 75·3° E Alt. 2900 feet
Soil type	Loam to clayey loam
Programme of research	Breeding and agronomical research on rice, wheat and maize

31. Seed Farm, Sirsa

Address and distance from Railway Station	Sirsa, District Hissar, Punjab; 2 miles from Sirsa Railway Station
When established	1944
Whether research, multiplication or demonstration farm	Seed multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	12 inches to 16 inches Lat. 29° N Long. 75° E Alt. 600 feet
Soil type	Medium loam
Programme of research	Research on agricultural crops, viz. sugarcane, cotton, wheat, berseem, *jowar*, *bajra*, etc.

32. Sugarcane Research Station, Jullundur

Address and distance from Railway Station	Jullundur, Punjab ; 1 mile from Jullundur Railway Station
When established	1934
Whether research, multiplication or demonstration farm	Research station
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	29 inches Lat. 31.5°N Long. 75.5°E Alt. 780 feet
Soil type	Loam and sandy loam
Programme of research	Research on evolution and selection of sugarcane varieties. Cultural and manurial aspects of cane culture as well as on control measures of sugarcane pests and diseases

33. Tobacco Research Station, Ferozepur

Address and distance from Railway Station	Ferozepur Cantt., Punjab ; 3½ miles from Ferozepur Cantt. Railway Station
When established	1948
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	It is being financed jointly by Indian Central Tobacco Committee, and the Punjab Government, and managed by the latter
Programme of research	In the substation, work on tobacco only is being done but on the farm itself research work on millets, gram and wheat is in progress

34. Tuber Research Station, Jullundur

Address and distance from Railway Station	Jullundur Agricultural Farm, Jullundur City, Punjab; ½ mile from Jullundur Railway Station
When established	1949
Whether research, multiplication or demonstration farm	Research station
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	30 inches Lat. 31°N Long. 75°E Alt. 778 feet
Soil type	Loam and sandy loam
Programme of research	Breeding and agronomical research on sweet potato and other tuber crops

35. Vegetable Research Station, Ludhiana

Address and distance from Railway Station	Ludhiana, Punjab ; ½ mile from Ludhiana Railway Station
When established	1951
Whether research, multiplication or demonstration farm	Research-*cum*-seed multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	28 inches Lat. 30.53°N Long. 76.2°E Alt. 806 feet
Soil type	Sandy loam to clayey loam
Programme of research	Research on breeding and agronomy of all vegetable crops, viz. peas, radish, turnip, gourd, water melon, *bhindi*, tomato, cauliflower, cabbage, onions and their seed multiplication

36. Vegetable Research Substation, Katrain

Address and distance from Railway Station	Katrain, District Kangra, Punjab ; 128 miles from Nagrota Railway Station
When established	1944
Whether research, multiplication or demonstration farm	Research-*cum*-seed production farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	60 inches Lat. 32.15°N Long. 75.15°E Alt. 5000 feet
Soil type	Sandy loam to loam
Programme of research	Research on breeding of all vegetable crops, viz. turnip, carrot, beet, radish, cabbage and their seed multiplication

37. Wheat Breeding Substation, Gurdaspur

Address and distance from Railway Station	Gurdaspur, Punjab ; Railway Station Gurdaspur
When established	1941
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed

Annual rainfall, latitude, longitude and altitude	38 inches Lat. 32.03°N Long. 75.25°E Alt. 874 feet
Soil type	Loam
Programme of research	Research on breeding of wheat, *mash* and *toria*

38. Bhopindra Agricultural Farm, Rauni

Address and distance from Railway Station	Rauni, District Patiala, 5 miles from Patiala Railway Station
When established	1923
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall	24 inches
Soil type	Clayey with *kallar* patches
Programme of research	Breeding and agronomical research on wheat, *jowar*, millets, *bajra*, gram, oats, cotton, oilseeds, sugarcane, rice, pulses, maize and crops like chillies, sweet potato, etc. Research on insect pests of oilseeds and cruciferous vegetables

39. (a) Maize Breeding Station, Ranbirpura
(b) Maize Breeding Substation, Kandaghat (Simla Hills)
(c) Bee Research Station, Kandaghat

Address and distance from Railway Station	(a) Ranbirpura, District Patiala, 3 miles from Dhablan Railway Station (b) Kandaghat, Simla Hills, Pepsu ; ¾ mile from Kandaoghat Railway Station (c) Kandaghat—Simla Hills—about 1 mile from the Kandaghat Railway Station at the Horticultural Centre
Whether research, multiplication or demonstration farm	Research farms
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	24 inches and 62 inches respectively
Soil type	Loam and clayey
Programme of research	a) Breeding and agronomical research on maize b) Research on bee management

40. Model Agricultural Farm, Faridkot

Address and distance from Railway Station	Faridkot, District Bhatinda, 6 furlongs from Faridkot Railway Station
When established	1910
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	16 inches Lat. 30.7°N Long. 74.8°E Alt. 550 feet
Soil type	Loam
Programme of research	Breeding and agronomical research on cotton, maize, wheat, oilseeds and fodder

41. Groundnut Experimental Station, Samrala

Address and distance from Railway Station	Samrala, District Ludhiana ; 7 miles from Khanan Railway Station
When established	1946
Whether research, multiplication or demonstration farm	Research station
State, University or private managed	State managed
Annual rainfall	26 inches
Soil type	Sandy
Programme of research	Breeding of improved varieties of groundnut and agronomic research on groundnut

42. Brassica Research Substation, Gurgaon

Address and distance from Railway Station	Gurgaon (Punjab) 3½ miles from Railway Station Gurgaon
When established	1952
Whether research, multiplication or demonstration farm	Research
State, University or private managed	State managed
Annual rainfall	25 inches
Soil type	Sandy
Programme of research	Breeding of improved varieties for Brassica, oilseeds and agronomic studies on these crops

43. Bee Research Station, Nagrota

Address and distance from Railway Station	Old Dak Bungalow, Nagrota ; one mile from Railway Station
When established	1938
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Programme of research	Research on bee management and bee enemies

44. Government Seed Farm, Jachh

Address and distance from Railway Station	Nurpur Road, 1/4 mile, District Kangra
When established	1949
Whether research, multiplication or demonstration farm	Seed multiplication farm
State, Universiry or private managed	State managed
Annual rainfall, latitude, longitude and altitude	60 inches Alt. 1500 feet above sea level
Soil type	Clayey soil
Programme of research	No research work ; only seed multiplication work is going on

45. Bhupindra Agricultural Farm, Rauni

Address and distance from Railway Station	B.A. Farm, Rauni, P.O. Ranbirpura, District Patiala ; 5½ miles from Patiala Railway Station
When established	1955
Whether research, multiplication or demonstration farm	Research station
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	30 inches Lat. 30.21° N Long. 76.1° E Alt. 825.8 feet
Soil type	Heavy loam
Programme of research	Research on breeding agronomy of *bhindi*, cauliflower, egg-plant, tomato and carrots

46. Agricultural Farm, Rohtak

Address and distance from Railway Station	Rohtak, District Rohtak, Punjab, 3 miles from Rohtak Railway Station
When established	1928
Whether research, multiplication or demonstration farm	District demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	18.0 inches Lat. 28.53° N Long. 76.37° E Alt. 725 feet
Soil type	Sandy loam and clayey loam
Programme of research	Varietal and manurial experiments on wheat, cotton and sugarcane. Seed multiplication of sugarcane, wheat and cotton, breeding work on gram and *bajra.*

PUNJAB

ANIMAL HUSBANDRY RESEARCH STATIONS

1. Government Fish Farm, Batala

Address and distance from Railway Station	Batala, District Gurdaspur, Punjab; 1 mile from Batala Railway Station
When established	1948
States, University or private managed	State managed
Programme of research	Location of spawning grounds in and around the three districts of Amritsar, Gurdaspur and Hoshiarpur, rearing and transport of fiish seed, investigations into food habit, growth maturity, breeding habits, high rate of mortality in fry fingerlings and stocked fish

2. Government Livestock Farm, Hissar

Address and distance from Railway Station	Hissar, Punjab ; 1 mile from Hissar Railway Station
When established	1809
State, University or private managed	State managed
Programme of research	The following research problems are under investigation at the Farm: Breeding and genetical experiments with Hariana cattle, investigation of important and obscure diseases of cattle, sheep, goats, poultry, camels, etc. and evolution of a clothing type fine wool Bikaneri sheep, Conducting investigation on problems relating to gynaecology and obstetrics, Investigation of encephalomyelitis among sheep and goats, Determination of normal worm burden in sheep and goats and normal faecal egg output in cattle and buffaloes

3. Punjab College of Veterinary Science and Animal Husbandry, Hissar

Address and distance from Railway Station	Hissar, Punjab, ½ mile from Railway Station, Hissar
When established	1948
State, University or private managed	State managed
Programme of research	Study of manufacture of veterinary biological products, vaccines, such as haemorrhagic septicaemia vaccine, anti-rabic vaccine, Ranikhet disease vaccine, fowl-pox vaccine, etc.

4. Government Poultry Farm, Gurdaspur

Address and distance from Railway Station	Gurdaspur, Punjab, about 1 mile from Gurdaspur Railway Station
When established	1927
State, University or private managed	State managed
Programme of research	Breeding Centre for improved type of White Leg-horn and Rhode Island Red birds. There are three Poultry Sub-Stations (Farms) at Ambala, Jullundur and Kangra working under it.

RAJASTHAN
AGRICULTURAL RESEARCH STATIONS

1. Laboratory of Agricultural Chemist, Kotah

Address and distance from Railway Station	Bargir Stables, Suraj Pole Gate, Kotah, Rajasthan ; 5 miles from Kotah Railway Station
When established	1952
Whether research, multiplication or demonstration farm	Research farm
State, University or privately managed	State managed
Programme of research	The main function of the laboratory is to assess the fertility of soils of the State and advise cultivators on their fertiliser requirements, water requirements, crop rotations, etc. Research is being conducted on indigenous types of soil improvers. This institution has taken up the detailed soil survey of the commanded area of Chambal Valley Development Project and classification (genetic and pedological) of the soils

2. Plant Breeding Research Station of Economic Botanist, Durgapura

Address and distance from Railway Station	Botanical Research Laboratory, Government Agricultural Farm, Durgapura (Jaipur), 2 miles from Durgapura Station
When established	1948
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication
State, University or private managed	State managed
Annual rainfall	18 inches
Soil type	Sandy loam
Programme of research	To find or evolve high yielding strains of crops by selection or breeding. The main crops dealt with at this station are wheat, fodder grasses and legumes, *bajra*, *kharif* pulses, and vegetables

3. Botanical Substation, Kotah

Address and distance from Railway Station	Karkhana Bagh, Police lines, Kotah, 5 miles from Kotah Railway Station
When established	1952
Whether research, multiplication or demonstration farm	Research farm, and nucleus seed production farm
State, University or private managed	State managed
Annual rainfall	30 inches
Soil type	Black cotton soils
Programme of research	The crop improvement work on *Barani* wheat (*durums*) *jowar*, linseed, sugarcane and gram is done at this centre

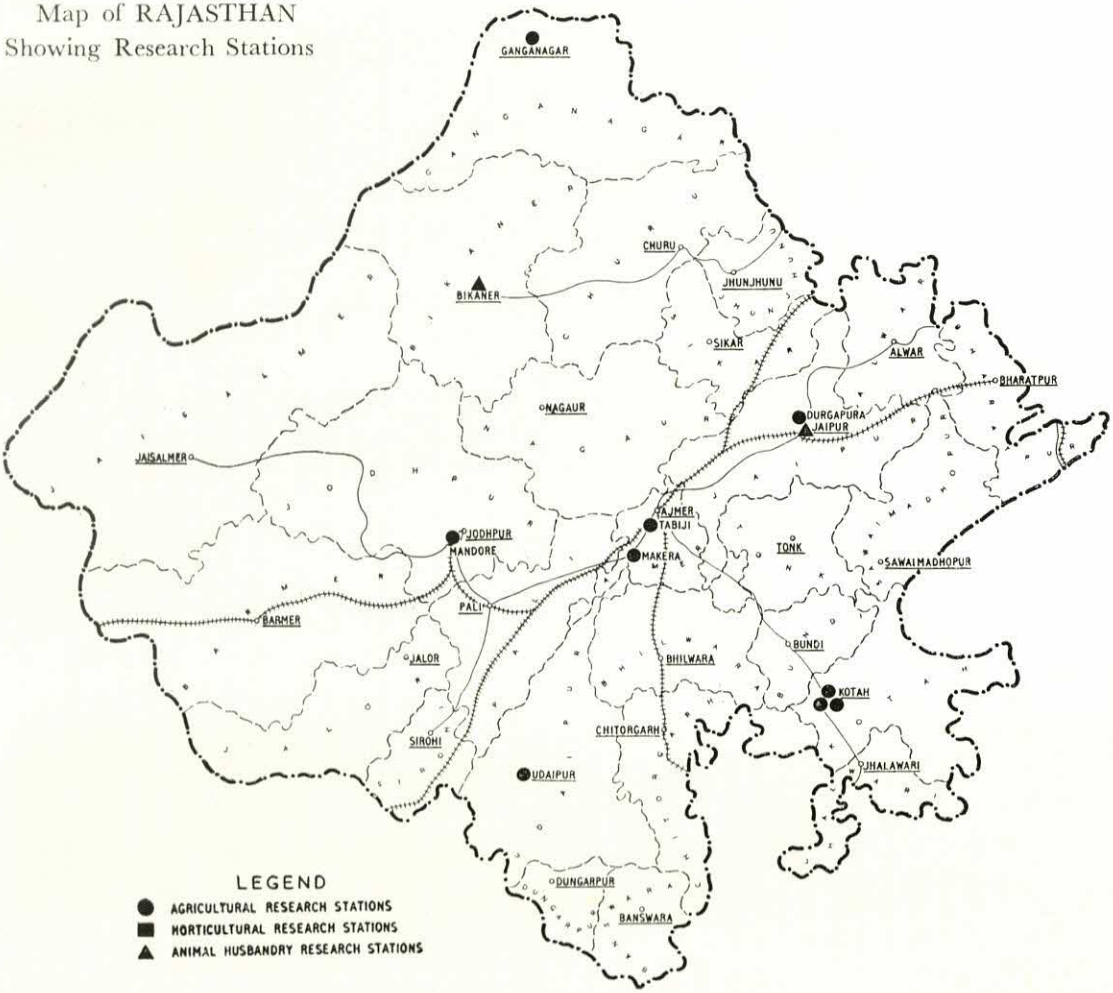
4. Botanical Substation, Mandore

Address and distance from Railway Station	Government Agricultural Farm, Mandore (Jodhpur), 5 miles from Jodhpur Railway Station
When established	1952
Whether research, multiplication or demonstration farm	Research-*cum*-seed multiplication farm
State, University or private managed	State managed
Annual rainfall	10 inches
Soil type	Sandy loam
Programme of research	The improvement of desert *bajra* and other *kharif* crops and trials of wheat and barley are carried on this station

5. Botanical Substation, Sri Ganganagar

Address and distance from Railway Station	Government Agricultural Farm, Sri Ganganagar
When established	1952
Whether research, multiplication or demonstration farm	Research and multiplication farm
State, University or private managed	State managed

Map of RAJASTHAN
Showing Research Stations



Annual rainfall	8 inches
Soil type	Sandy loam
Programme of research	To find suitable varieties for the tract; trials on wheat, gram, and sugarcane are carried on this farm

6. Botanical Substation, Bassi

Address and distance from Railway Station	Government Agricultural Farm, Bassi, one mile from Railway Station, Bassi (W. Rly.)
When established	1947
Whether research, multiplication or demonstration farm	Research and multiplication farm
State, University or private managed	State managed
Annual rainfall	20 inches
Soil type	Clay loam
Programme of research	This farm represents the heavy soils and the work on the improvement of barley, wheat, *bajra*, *moong*, etc. is done on this farm

7. Maize Breeding Station, Udaipur

Address and distance from Railway Station	Government Agricultural Farm, Udaipur; 3 miles from Railway Station Udaipur
When established	1951
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall	25 inches
Soil type	Clay loam
Programme of research	Maize improvement work is carried on here

8. Government Experimental Farm, Makera

Address and distance from Railway Station	Makera, Ajmer; 4 miles from Beawar Railway Station
When established	1936
Whether research, multiplication or demonstration Farm	Experimental farm
State, University or private managed	State managed
Annual rainfall, latitude longitude and altitude	18 inches Lat. 25° N Long. 73° E Alt. 1500 feet
Soil type	Sandy loam
Programme of research	Varietal and manurial trials on barley, cotton, oats and maize crops

9. Government Experimental Farm, Tabiji

Address and distance from Railway Station	Tabiji, District Ajmer, Ajmer; 2 miles from Tabiji Railway Station
When established	1936
Whether research, multiplication or demonstration farm	Experimental farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	18 inches Lat. 25° N Long. 73° E Alt. 1500 feet
Soil type	Sandy loam
Programme of research	Varietal and manurial trials on maize, barley and oats

10. Laboratory of Plant Pathologist, Kotah

Address and distance from Railway Station	Bargir Stables, Suraj Pole Gate, Kotah Rajasthan, 5 miles from Kotah Railway Station
When established	1953
Whether research, multiplication or demonstration farm	Research Farm

State, University or private managed	State managed
Programme of research	Plant disease investigation, control measures and their extension. Research on economical and effective chemical control measures on plant parasites and weeds. Research on deficiency diseases of crops and fruit plants. Research on *Zeera* wilt. Forecast and issue of warnings of plant diseases.

RAJASTHAN

ANIMAL HUSBANDRY RESEARCH STATIONS

1. Disease (Veterinary) Investigation Laboratory, Bikaner

Address and distance from Railway Station	Bikaner, Rajasthan, 3 miles from Bikaner Railway Station (N. Rly.)
When established	1951 at Jodhpur; shifted to Bikaner in 1954
State, University or private managed	State managed
Programme of research	Investigation of diseases of livestock with special attention to diseases caused by parasities and their control and cure and nutritional avitaminosis and rinderpest control

2. Pathological Laboratory (Veterinary), Jaipur

Address and distance from Railway Station	Government Veterinary Hospital, Jaipur, Rajasthan ; 2 miles from Railway Station
When established	1949
State, University or private managed	State managed
Programme of research	Survey of incidence of contagious abortion in cattle in Rajasthan, research on diseases caused by anaerobes, pathological studies of rabies and other diseases of nervous system and research on the incidence of cancer horn in cattle in Rajasthan.

UTTAR PRADESH

AGRICULTURAL RESEARCH STATIONS

1. Agricultural Research Station, Bulandshahr

Address and distance from Railway Station	Bulandshahr, Uttar Pradesh ; 2 miles from Bulandshahr Railway Station
When established	1914
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	28.67 inches Lat. 28.0° N Long. 77.0° E Alt. 650 feet
Soil type	Loam to clayey loam
Programme of research	Evolution of a long stapled strain of *desi* cotton which may be suitable for mill industry and may be suited to local climatic conditions, through the process of acclimatisation, selection and hybridisation. Efforts are in progress to improve the quality of the local survey selections by crossing them with quality cotton of other States. Research work is also done on fibre and tobacco crops

2. Central Sugarcane Station, Lucknow

Address and distance from Railway Station	Lucknow, Uttar Pradesh ; 3 miles from Lucknow Railway Station
When established	1949
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	30 inches Lat. 26.50° N Long. 80.55° E
Soil type	Loam
Programme of research	Growing of green fodder, sugarcane, wheat, oats, barley, gram and paddy

3. Agricultural College Research Farm, Kanpur

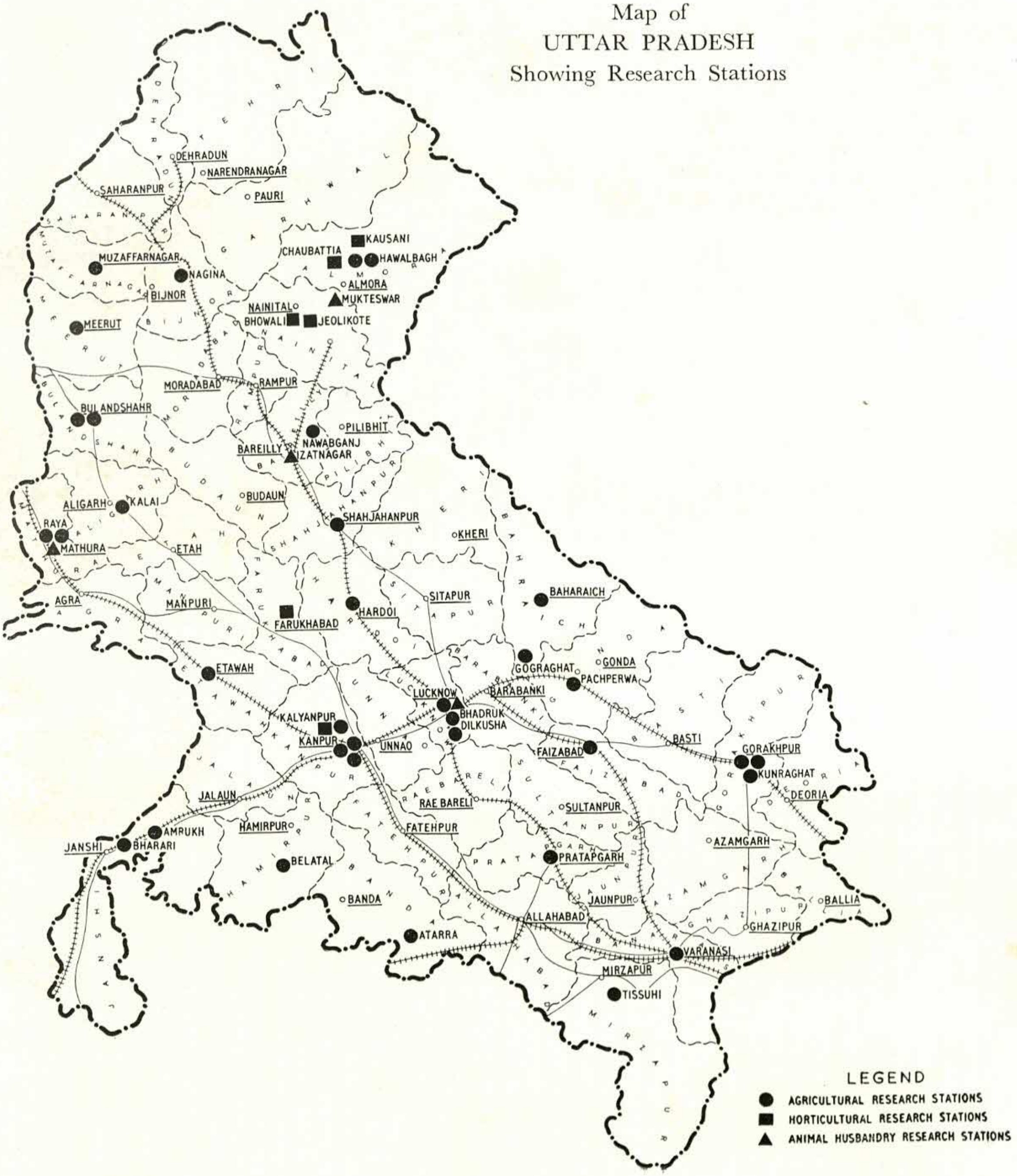
Address and distance from Railway Station	Government Agricultural College, Kanpur, Uttar Pradesh ; 2 furlongs from Rawatpur Railway Station
When established	1950
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	30 inches Lat. 27° N Long. 81.25° E
Soil type	Loam
Programme of research	Manurial trials on *rai*, studies on the bearing habit of important fruits, methods of vegetative propagation, cultural and manurial trials and effects of hormones on transplanting and diseases of fruits and vegetables. The programme includes research work on cereal smuts, bunts and stripe disease of barley, earcockle of wheat, wilt and rust of linseed, leaf spots and root-rot of groundnut, wilt of guava and preparation and distribution of berseem culture on mass scale

4. Government Agricultural School Farm, Bulandshahr

Address and distance from Railway Station	Bulandshahr, Uttar Pradesh ; 1 mile from Bulandshahr Railway Station
Whether research, multiplication or demonstration farm	Demonstration farm

[PLATE LXXVIII

Map of
UTTAR PRADESH
Showing Research Stations



State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	30 inches Lat. 77.75° N Alt. 1500 feet
Soil type	Loam and sandy loam
Programme of research	Experiments on cotton, wheat and paddy

5. Government Cotton Research Farm, Raya

Address and distance from Railway Station	Raya, District Mathura, Uttar Pradesh ; 2 miles from Raya Railway station
When established	1914
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed,	State managed
Annual rainfall, latitude, longitude and altitude	25 inches Lat. 30° N Long. 78° E Alt. 587 feet
Soil type	Loam
Programme of research	Varietal, cultural and manurial experiments on cotton. Other crops dealt with are wheat, barley, peas and gram

6. Government Farm, Hawalbagh

Address and distance from Railway Station	Hawalbagh, District Almora, Uttar Pradesh ; 74 miles from Kathgodam Railway Station.
When established	1944
Whether research, multiplication or demonstration farm	Experimental-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	35 inches Alt. 4300 feet
Soil type	Clay loam, sandy and clayey loam
Programme of research	Varietal trial on cotton. Other crops dealth with are wheat, peas, oats and paddy

7. Government Jute Farm, Gograghat

Address and distance from Railway Station	Gograghat, District Bahraich, Uttar Pradesh ; 1 mile from Gograghat Railway Station
When established	1948
Whether research, multiplication or demonstration farm	Experimental-*cum*-demonstration seed multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	45 inches Lat. 27.2° N Long. 81.5° E Alt. 356 feet
Soil type	Clay loam and loam
Programme of research	Varietal and manurial trials on jute. Other crops under trial are sugarcane, paddy, wheat and barley

8. Government Hill Fruit Research Station, Chaubattia

Address and distance from Railway Station	Chaubattia, District Almora, Uttar Pradesh ; 54 miles from Kathgodam Railway Sation
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication-cum-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	55 inches Lat. 29° N Long. 79° E Alt. 6500 feet
Soil type	Sandy quartzite, sandy micaceous, light loam heavy loam and hard clay organic
Programme of research	Research on all aspects of agriculture of apple, peach, apricot, etc.

9. Government Potato Research Farm, Farukhabad

Address and distance from Railway Station	Farukhabad, Uttar Pradesh ; 2 miles from Fatehgarh Railway Station
When established	1948
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	31 inches Lat. 27.4° N Long. 79.6° E Alt. 600 feet
Soil type	Medium to light sandy loam
Programme of research	Research on potatoes

10. Government Potato Research Station, Kausani

Address and distance from Railway Station	Kausani, District Almora, Uttar Pradesh ; 90 miles from Kathgodam Railway Station
When established	1948
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	60 inches Lat. 29.8° N Long. 79.8° E Alt. 6075 feet
Programme of research	Research on potatoes

11. Government Research Station, Kanpur

Address and distance from Railway Station	Nawabganj, Kanpur, Uttar Pradesh ; ½ mile from Kanpur Railway Station
When established	1906
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	33 inches Lat. 26.5° N Long. 80.3° E Alt. 430 feet
Programme of research	It is purely a research farm with about 87 acres under cultivation and caters for the field experiments of the two Economic Botanists, the Entomologist, the Agricultural Chemist and the Plant Pathologist under their instructions

12. Government Valley Fruit Research Station, Jeolikote

Address and distance from Railway Station	Jeolikote, District Nainital, Uttar Pradesh ; 11 miles from Kathgodam Railway Station
Whether research, multiplication or demonstration farm	Research station
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	80 inches Lat. 20.5° N Long. 80.0° E Alt. 3700 feet
Programme of research	Research on valley fruits

13. Institute of Crop Physiology, Dilkusha

Address and distance from Railway Station	Institute of Crop Physiology, Dilkusha, Lucknow, Uttar Pradesh ; 2 miles from Lucknow Railway Station
When established	1948
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	24 inches

	Lat. 26.55° N Long. 80.59° E Alt. 390 feet
Soil type	Sandy loam
Programme of research	The key experiments are performed at this station and repeated on regional basis at the outside research substations to investigate the influence of soil, climate, variety, manuring, cultivation and cultural practices on growth, developmental physiology, yield and quality of produce and soil fertility

14. Late Paddy Research Substation, Pachperwa

Address and distance from Railway Station	Pachperwa, District Gonda, Uttar Pradesh ; 2 miles from Pachperwa Railway Station
When established	1949
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	32 inches Lat. 27° N Long. 82° E Alt. 350 feet
Soil type	Clayey
Programme of research	Varietal, manurial and cultural experiments on paddy. Other crops under study are gram and peas

15. Late Paddy Research Substation, Tissuhi

Address and distance from Railway Station	Tissuhi P.O. Marihan, District Mirzapur, Uttar Pradesh ; 19 miles from Mirzapur Railway Station
When established	1949
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	40 inches Lat. 25° N Long. 83° E Alt. 700 feet
Soil type	Hard clay
Programme of research	Varietal, manurial and cultural trials on paddy. Other crops handled are wheat, gram, pea and *masoor*

16. Main Sugarcane Research Station, Shahjahanpur

Address and distance from Railway Station	Shahjahanpur, Uttar Pradesh ; 2½ miles from Shahjahanpur Railway Station
When established	1941
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	Lat. 27.53° N Long. 79.54° E Alt. 507 feet
Programme of research	Research work on all aspects of sugarcane cultivation. Varieties selected and released so far include Co. 453, Co. 527, Co. 513 (from seedlings raised at Coimbatore) and Co. S, 186, Co. S, 186, Co. S, 245 and Co. S, 321 from Shahjahanpur

17. Potato Multiplication Substation, Bhowali

Address and distance from Railway Station	Bhowali, District Nainital, Uttar Pradesh ; 22 miles from Kathgodam Railway Station
When established	1944
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	70 inches

	Lat. 29.23°N Long. 79.31°E Alt. 5000 feet
Soil type	Loam and sandy loam to stony
Programme of research	Multiplication of suitable varieties of potatoes. Manuria trials to study the effect of N,P,K, and organic manures singly and in combinations are in progress

18. Research Substation, Atarra

Address and distance from Railway Station	Atarra, District Banda; 1 mile from Atarra Railway Station
Whether research, multiplication or demonstration farm	Multiplication-*cum*-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	36 inches Lat. 25.28°N Long. 82.22°E
Soil type	Light *kabar* and *parwa*
Programme of research	The key experiments are performed at the main station and repeated here on regional basis

19. Research Substation, Baharaich

Address and distance from Railway Station	Baharaich, Uttar Pradesh ; 2½ miles from Baharaich Railway Station
Whether research, multiplication or demonstration farm	Multiplication-*cum*-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	35 inches Lat. 27.34°N Long. 81.38°E Alt. 407 feet
Soil type	Sandy loam
Programme of research	The key experiments are performed at the main station and repeated here on regional basis

20. Regional Research Station, Varanasi

Address and distance from Railway Station	Varanasi, Uttar Pradesh ; 3 miles from Varanasi Railway Station
Whether research, multiplication or demonstration farm	Regional Research Station
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	42 inches Lat. 25.20°E Long. 83.00°E Alt. 265 feet
Soil type	Clayey loam
Programme of research	The key experiments are performed at the main station and repeated here on regional basis. They include investigation on the influence of soil, climate, variety, manuring, cultural practices on growth, developmental physiology and quality of wheat ; also tests on soil fertility

21. Research Substation, Bharari

Address and distance from Railway Station	Bharari, Uttar Pradesh ; 8 miles from Jhansi Railway Station
Whether research, multiplication or demonstration farm	Mechanised farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	29 inches Lat. 25.27°N Long. 70.37°E Alt. 824 feet
Soil type	*Rakar* and *kabar*
Programme of research	The key experiments are performed at the main station and repeated here on regional basis

22. Research Substation, Belatal

Address and distance from Railway Station	Belatal, District Hamirpur, Uttar Pradesh ; ½ mile from Belatal Railway Station
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	27 inches Lat. 25.12°N Long. 80.10°E
Soil type	Hard *kabar*
Programme of research	The key experiments are performed at the main station and repeated here on regional basis

23. Research Substation, Etawah

Address and distance from Railway Station	Etawah, Uttar Pradesh ; 1 mile from Etawah Railway Station
Whether research, multiplication or demonstration farm	Seed and demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	26 inches Lat. 26.47°N Long. 79.20°E
Soil type	Clayey loam
Programme of research	The key experiments are performed at the main station and repeated here on regional basis

24. Research Substation, Faizabad

Address and distance from Railway Station	Faizabad, Uttar Pradesh ; 4 miles from Faizabad Railway Station
Whether research, multiplication or demonstration farm	Multiplication-*cum*-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	35 inches Lat. 26.47°N Long. 82.12°E
Soil type	Clayey loam
Programme of research	The key experiments are performed at the main station and repeated here on regional basis. The trials include investigation on the influence of soil, climate, variety, manuring, cultural practices on growth, developmental physiology and quality of wheat ; also tests on soil fertility

27. Research Substation, Gorakhpur

Address and distance from Railway Station	Gorakhpur, Uttar Pradesh ; 4 miles from Gorakhpur Railway Station
Whether research, multiplication or demonstration farm	Instructional farm
State, University or private managed	State managed
Annual rainfall, latitude and longitude	49 inches Lat. 26.45°N Long. 83.24°E
Soil type	Sandy loam
Programme of research	The key experiments are performed at the main station and repeated here on regional basis

26. Regional Research Station, Hardoi

Address and distance from Railway Station	Hardoi, Uttar Pradesh ; 3 miles from Hardoi Railway Station
Whether research, multiplication or demonstration farm	Regional research station
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	26 inches Lat. 27.54°N Long. 80.10°E
Soil type	Loam
Programme of research	The key experiments are performed at the main station and repeated here on regional basis

27. Research Substation, Hawalbagh

Address and distance from Railway Station	Hawalbagh, District Almora ; 6 miles from Almora Out-Agency
Whether research, multiplication or demonstration farm	Seed and demonstration farm
State, Universiry or private managed	State managed
Annual rainfall, latitude, longitude and altitude	64 inches Lat. 29.37°N Long. 79.40°E
Soil type	Clayey loam
Programme of research	The key experiments are performed at the main station and repeated here on regional basis

28. Research Substation, Kalai

Address and distance from Railway Station	Kalai, District Aligarh, Uttar Pradesh ; 11 miles from Aligarh Railway Station
Whether research, multiplication or demonstration farm	Seed and demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	38 inches Lat. 27.54°N Long. 78.60°E Alt. 615 feet
Soil type	Loam
Programme of research	The key experiments are performed at the main station and repeated here on regional basis

29. Research Substation, Kalyanpur

Address and distance from Railway Station	Kalyanpur, District Kanpur, Uttar Pradesh ; 8 miles from Kanpur Railway Station
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	31 inches Lat. 24.80°N Long. 28.24°E Alt. 500 feet
Soil type	Loam
Programme of research	The key experiments are performed at the main station and repeated here on regional basis

30. Sugarcane Research Substation, Kunraghat

Address and distance from Railway Station	Kunraghat, District Gorakhpur, Uttar Pradesh ; 2 miles from Gorakhpur Railway Station
Whether research, multiplication or demonstration farm	Research farm
State, Universiry or private managed	State managed
Annual rainfall, latitude, longitude and altitude	49 inches Lat. 26.45°N Long. 83.24°E
Soil type	Sandy loam
Programme of research	The key experiments on sugarcane are performed. Study on other crops like wheat, barley, gram, pea, *jowar*, etc. is also undertaken

31. Regional Research Station, Meerut

Address and distance from Railway Station	Meerut, Uttrar Pradesh ; 2 miles from Meerut Railway Station
Whether research, multiplication or demonstration farm	Regional research station
State. University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	35 inches Lat. 29.10°N Long. 77.45°E

Soil type	Loam
Progamme of research	The key experiments are performed at the main station and repeated here on regional basis

32. Sugarcane Research Substation, Muzaffarnagar

Address and distance from Railway Station	Muzaffarnagar, Uttar Pradesh, 1 mile from Muzaffarnagar Railway Station
Whether research, multiplication or demonstraion farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	39 inches Lat. 29.28°N Long. 77.44°E
Soil type	Medium loam
Programme of research	The key experiments on sugarcane are performed here. Study on other crops like wheat, barley, gram, pea, etc. is also undertaken

33. Research Substation, Pratapgarh

Address and distance from Railway Station	Pratapgarh, Uttar Pradesh ; 2 miles from Pratapgarh Railway Station
Whether research, multiplication or demonstration farm	Multiplication-*cum*-demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	29 inches Lat. 25.34°N Long. 81.59°E
Soil type	Light loam
Programme of research	The key experiments are performed at the main station and repeated here on regional basis

34. Research Substation, Raya

Address and distance from Railway Station	Raya, District Mathura, Uttar Pradesh ; 1½ miles from Raya Railway Station
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	25 inches Lat. 30°N Long. 78°E Alt. 587 feet
Soil type	Sandy loam
Programme of research	The key experiments are performed at the main station and repeated here on regional basis

35. Rice Research Station, Nagina

Address and distance from Railway Station	Nagina, District Bijnor, Uttar Pradesh ; 1½ miles from Nagina Railway Station
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	47 inches Lat. 29.5°N Long. 78.5°E Alt. 650 feet
Soil type	Loam
Programme of research	Varietal, manurial, cultural and breeding experiments on paddy. Other crops under study are wheat, berseem, *jowar*, peas, gram and sugarcane

36. Rice Research Substation, Kunraghat

Address and distance from Railway Station	Kunraghat, District Gorakhpur, Uttar Pradesh ; 1½ furlongs from Kunraghat Railway Station
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm

State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	43 inches Lat. 26°5°N Long. 83.5°E Alt. 255 feet
Soil type	Loam
Programme of research	Varietal manurial and cultural experiments on paddy, wheat, gram and peas

37. Students Instructional Farm, Kanpur

Address and distance from Railway Station	Agricultural College Kanpur, Uttar Pradesh ; 5 miles from Kanpur Railway Station
When established	1932
Whether research, multiplication or demonstration farm	Instructional as well as research work
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	30 inches Lat. 27°N Long. 81.25°E
Programme of research	Instruction and research on sugarcane, *chari*, maize, *mung*, paddy, *arhar*, wheat, barley, oats, gram and peas, linseed and berseem

38. Regional Research Station, Nawabganj

Address and distance from Railway Station	Nawabganj, District Bareilly, U.P., 3 miles from the Railway Station
Whether research, multiplication or demonstration farm	Regional Research Station
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	35 inches Lat. 28.5°N Long. 79.5°E
Soil type	Clayey loam
Programme of research	The key experiments are performed at the main station and repeated here on regional basis

39. Regional Research Station, Amrukh

Address and distance from Railway Station	Amrukh, District Jhansi, U.P., 37½ miles from Jhansi,—36 miles on Jhansi-Kanpur Road and 1½ miles west to it
Whether research, multiplication or demonstration farm	Regional Research Station
State, University or private managed	State managed
Annual rainfall, latitude longitude and altitude	40 inches Lat. 24°N Long. 78°E
Soil type	*Parua*, *kabar* and its mixture
Programme of research	The key experiments are performed at the main station and repeated here on regional basis

40. Vegetable Research Station, Kalyanpur

Address and distance from Railway Station	Kalyanpur, District Kanpur, Uttar Pradesh, 8 miles from Kanpur Railway Station
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	31 inches Lat. 24.80°N Long. 82.24°E Alt. 500 feet
Soil type	Loam
Programme of research	Research on vegetables

41. Horticultural Research Station, Saharanpur

Address and distance from Railway Station	Horticultural Research Station, Saharanpur, Uttar Pradesh; Saharanpur Railway Station
Whether research, multiplication or demonstration farm	Research Station
Whether State, University or private managed	State managed
Programme of research	Fertiliser trials and agronomic research and fruits and vegetables

UTTAR PRADESH

ANIMAL HUSBANDRY RESEARCH STATIONS

1. Biological Products Section, Lucknow

Address and distance from Railway Station	Department of Animal Husbandry, Badshahbagh, Uttar Pradesh ; 6 miles from Lucknow Railway Station
When established	1945
State, University or private managed	State managed
Programme of research	Mass production of veterinary biologicals required for the control of major preventible and common contagious diseases of livestock and poultry is undertaken at this institute. Allied and applied researches conducive to economic production without sacrificing efficiency of biologicals are carried out

2. U.P. College of Veterinary Science-*cum*-Livestock Research Station-*cum*-Dairy Demonstration farm, Mathura

Address and distance from Railway Station	Mathura, Uttar Pradesh ; 3 miles from Mathura Railway Station
When established	1947
State, University or private managed	State managed
Programme of research	Adoption of better breeds and supply of pure-bred stud bulls to the breeding centres. Search for local feeds and fodders to assure better nutrition of animals and remedial measures for the prevention of epizootics and other diseases of economic importance

WEST BENGAL

AGRICULTURAL RESEARCH STATIONS

1. Agricultural Research Farm, Berhampore

Address and distance from Railway Station	Berhampore, District Murshidabad, West Bengal ; 3 miles from Berhampore Railway Station
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall	40 to 50 inches
Soil type	Sandy loam
Programme of research	Research on gram, other pulses, sugarcane, cotton, rice, wheat, oilseeds, jute, and potato

2. Agricultural Research Institute, Tollygunj

Address and distance from Railway Station	Tollygunj, District 24-Parganas ; West Bengal ; 10 miles from Sealdah Railway Station
When established	1951
Whether research, multiplication or demonstration farm	Research farm
State University or private managed	State managed
Annual rainfall	65 inches
Soil type	Sandy
Programme of research	Agronomical research on cotton, jute, pulses and oilseeds and on subsidiary food crops, viz. potato, brinjal, wheat and guava

3. Banana Research Station, Chinsura

Address and distance from Railway Station	Chinsura, District Hooghly, West Bengal ; 1 mile from Chinsura Railway Station
When established	1949
Whether research, multiplication or demonstration farm	Research station
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	58 inches Lat. 22.5°N Long. 88.24°E Alt. 28 feet
Soil type	Clay loam
Programme of research	Research on banana fruit

4. Horticultural Research Station, Krishnagar

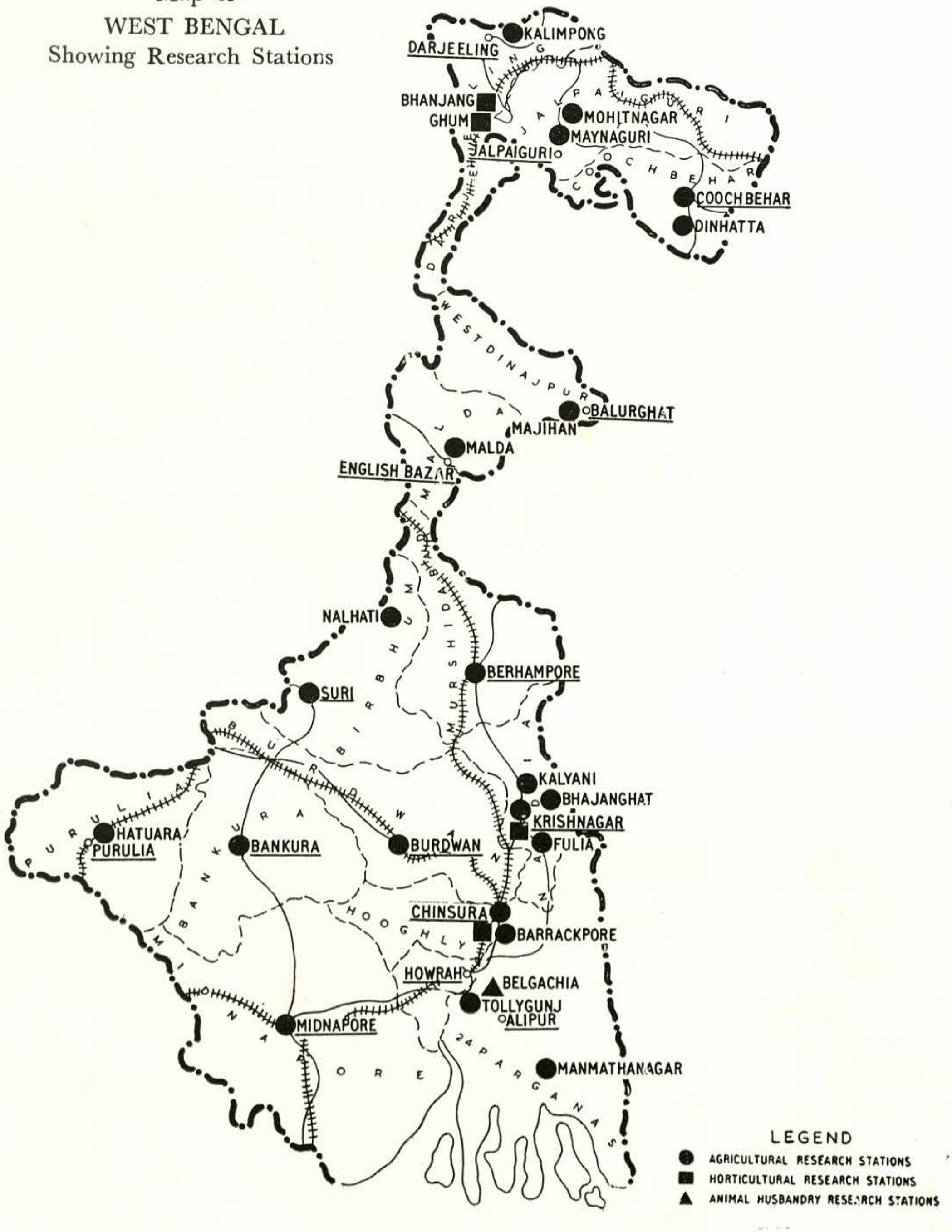
Address and distance from Railway Station	Krishnagar, District Nadia, West Bengal ; 2 miles from Krishnagar Railway Station
When established	1934
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Programme of research	Horticultural problems on all fruits and vegetables, breeding and selection work to evolve better varieties of mango, litchi, guava, pineapple, papaya, citrus fruits, banana, jack-fruit, custard apple, bel amongst fruits, and pumpkin, lady's-finger, cucumber, amaranthus, cauliflower, tomato, brinjal, spinach, garden pea and sweet potato

5. Potato Experimental Station, Bhanjang

Address and distance from Railway Station	Bhanjang, District Darjeeling, West Bengal; 4 miles from Ghum Railway Station
When established	1944
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	124 inches Lat. 27.2° N

[PLATE LXXIX

Map of
WEST BENGAL
Showing Research Stations



	Long. 88.14° E
	Alt. 7400 feet
Soil type	Loam
Programme of research	Breeding and agronomic research on food crops, viz. potato, cabbage, cauliflower, peas and radish

6. Rangbull Seed Multiplication Farm, Ghum

Address and distance from Railway Station	Ghum, District Darjeeling, West Bengal, 8 miles from Ghum Railway Station
When established	1947
Whether research, multiplication or demonstration farm	Multiplication-*cum*-research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	126 inches
	Lat. 27° N
	Long. 88.10° E
	Alt. 7200 feet
Soil type	Loam clayey loam
Programme of research	Breeding and agronomical research on potato, peas, cauliflower, cabbage and radish

7. Research-*cum*-Demonstration Farm, Bankura

Address and distance from Railway Station	Bankura, District Bankura, West Bengal; 3 miles from Bankura Railway Station
When established	1932
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	50 inches
	Alt. 328 feet
Soil type	Laterite
Programme of research	Cultural and manurial experiments on agricultural crops, viz., cotton, pulses, wheat, rice and oilseeds

8. Research and Demonstration Farm, Suri

Address and distance from Railway Station	Suri, District Birbhum, West Bengal, 2 miles from Suri Railway Station
When established	1932
Whether research, multiplication or demonstration farm	Demonstration farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	40 inhces
Soil type	Laterite
Programme of research	Research on agave, savai grass, oilseeds and other agricultural crops, viz. wheat, rice, pulses, etc.

9. Research-*cum*-Multiplication Farm, Manmathanagar

Address and distance from Railway Station	Manmathanagar, District 24-Parganas, West Bengal; 28 miles from Canning Railway Station
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	59 to 60 inches
	Alt. 29 feet
Soil type	Saline
Programme of research	Research on paddy to breed high yielding types and to conduct agronomical trials on this crop

10. Research-*cum*-Multiplication Farm, Kalimpong

Address and distance from Railway Station	Kalimpong, District Darjeeling, West Bengal; 43 miles from Siliguri Railway Station
When established	1949
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication farm
State, University or private managed	State managed

Annual rainfall, latitude longitude and altitude	Alt. 4000 feet
Soil type	Sedentary
Programme of research	Breeding and agronomical research on maize, pulses, paddy and wheat crops

11. Research Farm, Chinsura

Address and distance from Railway Station	Chinsura, District Hooghly, West Bengal; 1 mile from Chinsura Railway Station
When established	1932
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed?	State managed
Annual rainfall, latitude, longitude and altitude	50 inches Lat. 22.52° N Long. 88.24° E Alt. 28 feet
Soil type	Alluvial
Programme of research	Research on sugarcane, wheat, pulses, jute, barley, oats, rice and oilseeds. Rice breeding is the main work but work on other agricultural crops is also in progress

12. Research-*cum*-Demonstration Farm, Midnapore

Address and distance from Railway Station	Midnapore, West Begal; 3 miles from Midnapore Railway Station
Whether research, multiplication or demonstration farm	Research farm
State, University or private managed	State managed
Annual rainfall	40-50 inches
Soil type	Laterite
Programme of research	Agronomical research on *rahar*, sugarcane, rice, cotton and oilseeds

13. Research-*cum*-Multiplication Farm,Malda

Address and distance from Railway Station	Malda; about 3 miles away from Malda Railway Station
Whether research, multiplication or demonstration farm	Research-*cum*-multiplication
State, University or private managed	State managed
Annual rainfall	25 inches
Soil type	Ganga riverine
Programme of research	Multiplication of paddy seeds

14. Research-*cum*-Demonstration Farm, Cooch Behar

Address and distance from Railway Station	Cooch Behar; by the side of Cooch Behar Railway Station
Whether research, multiplication or demonstration farm	Research-*cum*-demonstration
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	111.33 inches Lat. 26°-20' O.N Long. 89°-27' O.E
Soil type	Buxa riverine
Programme of research	Agronomic research and fertiliser trials to increase paddy yield

15. Research-*cum*-Demonstration farm, Maynaguri

Address and distance from Railway Station	Maynaguri (Jalpaiguri); 2 miles away from Maynaguri Road Railway Station
Whether research, multiplication or demonstration farm	Research-*cum*-demonstration
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	129 ft. 1 inches Lat. 26°-32′ O.N. Long. 88°-43′ O.E.

Soil type	Tista riverine
Programme of research	All types of research on paddy and jute

16. Research-*cum*-Demonstration Farm, Hatuara

Address and distance from Railway Station	Hatuara (Purulia) ; about 2 miles away from Charra Railway Station
Whether research, multiplication or demonstration farm	Research-*cum*-demonstration
State, University or private managed	State managed
Soil type	Lateritic
Programme of research	All aspects of research on paddy crop

17. Jute Seed Multiplication Farm, Krishnagar

Address and distance from Railway Station	Krishnagar (Nadia) ; about 2 miles away from Krishnagar City Railway Station
When established	1951
Whether research, multipliction or demonstration farm	Multiplication farm
State, University or private managed	State managed
Annual rainfall latitude longitude and altitude	60.06 inches Lat. 23°-24′ O.N. Long. 88°-31′ O.E.
Soil type	Ganga riverine
Programme af research	Multiplication of good variety of jute seeds

18. Jute Seed Multiplication Farm, Bhajanghat

Address and distance from Railway Station	Bhanjaghat (Nadia) ; about 3 miles away from Majdiah Railway Station
When established	1956
Whether research, multiplication or demonstration farm	Multiplication
State, University or private managed	State managed
Annual rainfall, latitude, longitude, and altitude	55-98 inches Lat. 20°-10′ O.N. Long. 88°-34′ O.E.
Soil type	Sandy loam
Programme of research	Jute seed multiplication

19. Paddy Seed Multiplication Farm, Kalyani

Address and distance from Railway Station	Kalyani (Nadia), about 3 miles away from Kanchrapara Railway Station
When established	1954
Whether research, multiplication or demonstration farm	Multiplication farm
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	39.31 inches Lat. 22°-58′ I.N. Long. 88°-34′ O.E.
Soil type	Loamy
Programme of research	Seed multiplication

20. Seed Multiplication Farm, Fulia

Address and distance from Railway Station	Fulia (Nadia), about 1½ miles away from Fulia Railway Station
When established	1953
Whether research, multiplication or demonstration farm	Multiplication
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	55.98 inches Lat. 22°-10′ O.N. Long. 88°-34′ O.E.
Soil type	Ganga riverine
Programme of research	Seed multiplication

21. Seed Multiplication Farm, Majihan

Address and distance from Railway Station	Majihan (West Dinajpur); about 47 miles away from Kaliaganj Railway Station
When established	1955
Whether research, multiplication or demonstration farm	Multiplication
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	66.83 inches Lat. 25°-13′ O.N. Long. 88°-47′0. E.
Soil type	Loamy
Programme of research	Seed multiplication for distribution

22. Seed Multiplication Farm, Burdwan

Address and distance from Railway Station	Burdwan ; about 3 miles away from Burdwan Railway Station
When established	1949
Whether research, multiplication or demonstration farm	Multiplication
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	59.15 inches Lat. 23°-14' O.N. Long. 87°-51' O.E.
Soil type	Damodar flat lands
Programme of research	Seed multiplication

23. Seed Multiplication Farm, Nalhati

Address and distance from Railway Station	Nalhati (Birbhum), about one mile away from Nalhati Railway Station
When established	1955
Whether research, multiplication or demonstration farm	Multiplication
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	34.29 inches Lat. 24°-17' O.N. Long. 87°-51' O.E.
Soil type	Laterite
Programme of research	Multiplication of jute and paddy seed

24. Seed Multiplication Farm, Mohitnagar

Address and distance from Railway Station	Mohitnagar (Jalpaiguri) about 5 miles away from Jalpaiguri Railway Station
When established	1955
Whether research, multiplication or demonstration farm	Multiplication
State, University or private managed	State managed
Annual rainfall, latitude, longitude and altitude	128.63 inches Lat. 26°-32' O.N. Long. 88°-40' O.E.
Soil type	Sandy loam
Programme of research	Multiplication of jute and paddy seed.

WEST BENGAL
ANIMAL HUSBANDRY RESEARCH STATIONS

1. Bengal Veterinary College, Calcutta

Address and distance from Railway Station	Belgachia, Calcutta—37, West Bengal : 3 miles from Calcutta (Sealdah Railway Station)
When established	1893, but integration of Bengal Veterinary Research Institute in its fold was in 1953
State, University or private managed	State managed
Programme of research.	1) Scheme for studying cattle sterility 2) Scheme on the findings of physiological norms in domestic animals in Bengal 3) Scheme for control and eradication of stephanofilariasis (humpsore among cattle in West Bengal) 4) Scheme for eradication of rinderpest and of dried rinderpest vaccine on regional basis.

APPENDICES

APPENDIX I

EXPENDITURE ON AGRICULTURAL RESEARCH

SINCE its establishment, the Indian Council of Agricultural Research has actively engaged itself in promoting research both in agriculture and animal husbandry. The Council can claim its legitimate share in the successful research achievements on rice, wheat, barley, maize, millets, pulses, oilseeds, fruits and horticulture, tuber crops, sugarcane, grasses and fodder crops, fibres, tobacco, control of plant diseases and pests, manurial trials, dry farming, investigation and control of animal diseases, animal nutrition, animal breeding and dairying. Compared to only a few schemes in 1929-30, the Council at present finances about 1000 schemes which are all in operation. In addition, 608 schemes have already been completed. Since its inception, the Council has spent Rs. 5,49,48,000 on various schemes and its annual expenditure on research ranges from Rs. 55 to 60 lakhs.

A statement showing the income of each Commodity Committee and its annual expenditure on research and the expenditure incurred on research by the Central Institutes set up by the Government of India during the last five years is appended.

Statement showing the income of the I.C.A.R. and Commodity Committees from 1951 to 1956

Name of organisation	1951-52	1952-53	1953-54	1954-55	1955-56	Total
Indian Council of Agricultural Research	51,09,700	51,16,400	52,94,900	79,37,800	73,14,000	307,72,800
Indian Central Oilseeds Committee	16,17,248	12,35,043	15,11,229	18,32,840	23,49,389	85,45,749
Indian Central Sugarcane Committee	6,60,689	20,86,707	15,30,770	8,81,808	8,62,043	60,21,417
Indian Central Tobacco Committee	2,28,243	10,57,851	10,09,805	11,02,280	19,48,053	53,46,232
Indian Central Jute Committee	10,25,539	10,25,010	12,40,748	25,24,664	11,46,347	69,62,308
Indian Lac Cess Committee	8,43,483	7,89,166	7,04,543	6,89,818	7,40,659	37,67,669
Indian Central Cotton Committee	11,54,060	12,22,366	12,96,466	12,88,636	15,08,478	64,70,006
Indian Central Arecanut Committee	9,278	2,06,005	1,59,147	1,67,755	2,13,752	7,56,037
Indian Central Coconut Committee	7,45,712	3,43,265	6,77,589	7,76,163	8,26,689	33,69,418
Grand total	113,93,352	130,81,813	134,26,197	172,01,764	169,09,510	720,11,636

Statement showing the expenditure incurred by the I.C.A.R., Commodity Committees and Central Research Institutes from 1951 to 1956

Name of organisation	1951-52	1952-53	1953-54	1954-55	1955-56	Total
I. Research Institutes						
Indian Agricultural Research Institute Indian Veterinary Research Institute, Izatnagar	18,51,914	21,63,958	24,37,376	25,69,423	27,15,136	117,37,707
Indian Veterinary Research Institute, Mukteswar	26,69,083	29,17,225	31,02,852	30,90,684	32,72,910	150,52,754
Indian Central Rice Research Institute	3,19,327	4,03,955	4,43,659	6,46,538	7,57,329	25,70,808
Indian Central Potato Research Institute	2,57,896	3,16,728	2,83,650	2 88,502	2,89,196	14,35,972
National Dairy Research Institute	6,75,615	8,25,841	8,17,798	8,15,036	8,56,750	39,91,040
II. I.C.A.R. and Commodity Committees						
Indian Council of Agricultural Research	36,50,200	24,64,800	41,49,200	51,29,400	57,23,900	211,17,500
Indian Central Oilseeds Committee	2,00,092	3,63,307	3,24,067	4,49,106	5,17,415	18,53.987
Indian Central Sugarcane Committee	15,44,560	17,33,948	14,66,566	5,42,682	6,32,118	59,19,874
Indian Central Tobacco Committee	6,24,654	8,03,777	9,30,909	9,14,286	10,48,498	43,22,124
Indian Central Jute Committee	9,04,268	12,76,192	16,40,661	11,45,869	20,42,230	70,10,220
Indian Lac Cess Committee	3,34,647	4,49,358	4,63,111	4,71,382	4,60,471	21,78,961
Indian Central Cotton Committee	9,45,515	8,82,347	11,29,837	13,28,369	15,07,171	57,93,238
Indian Central Arecanut Committee	1,61,002	22,831	89,071	64,192	77,174	4,14,270
Indian Central Coconut Committee	3,73,688	2,83,238	3,25,530	4,36,211	4,04,682	18,23,259
Grand total	14,51,2461	149,07,405	176,92,589	178,92,589	203,04,980	852,21,722

APPENDIX II

TECHNICAL PERSONNEL OF THE CENTRAL RESEARCH INSTITUTES AND COMMODITY COMMITTEES

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INDIAN AGRICULTURAL RESEARCH INSTITUTE

New Delhi

Name	*Designation*
Dr. B.P. Pal, M.Sc., Ph. D. (Cantab), F.N.I., F.L.S., F.B.S.	Director

Division of Agronomy

Name	*Designation*
Dr. P.C. Raheja, M. Sc., Ph. D., D. Sc.	Head of the Division of Agronomy
Shri S. Sen, M. Sc.	Agronomist
Shri A.R. Khan, B.Sc. (Ag.), M.Sc. (Wis.)	do.
Post-graduate I.A.R.I.	
Dr. J.N. Sharma, B.Sc. (Ag.); M.Sc. (Bot.)	do.
Assoc. IARI—Hort. Dip., Ph. D., (Minn)	do.
Dr. R.D. Verma, B.Sc. (Pb); B.Sc. (Hons); M.S. (Iowa);	do.
Dr. Mukhtar Singh, B.Sc. (Ag.); M.Sc. Ag., Ph. D.	do.
Dr. P.N. Saxena, M.A.,Ph. D.	Head of the Statistics Section
Shri J.J. Chandnani, M.Sc. (Ag.)	Assistant Agronomist
Shri S.S. Bains, B. Sc. (Ag.), Assoc. I.A.R.I.	Farm Superinteudent
Dr. H.S. Mann, B. Sc. (Ag.), M Sc. Agri., M.Sc. (Eco.)	
Ph.D. (Ag.)	Assistant Agronomist
Dr. K.S. Yawalkar, B.Sc. (Ag.), Ph. D. Assoc. I.A.R.I.	do.
Shri S.R. Obhroi, B.Sc. (Ag.), Assoc. I.A.R.I.	Agri. Development Officer
Shri R.S. Gupta, B.Sc. (Ag.), Assoc. I.A.R.I.	Assistant Agronomist
Shri A.G. Kavitkar, B.Sc., Assoc. I.A.R.I.	Assistant Statistician
Dr. Gian Singh, L.V.P. (Hons), P.G.	Lecturer in Veterinary Science
Dr. A.S. Kahlon, M.A. (Economics), M.A. (History), B.T.	Lecturer in Agriculture Economics
Dr. Diwan Singh, M. Sc. (Ag.)	Lecturer in Agriculture
Shri K.P. Misra, M.Sc. (Ag. Bot.), Assoc. I.A.R.I. (Agronomy)	Research Assistant
Shri L.L. Relwani, B.Sc. (Ag.), Assoc. I.A.R.I.	do.
Shri B.P. Mathur, B.Sc. (Ag.), Assoc. I.A.R.I.	do.
Shri N.K. Chopra, B.Sc. (Ag.), Assoc. I.A.R.I.	do.
Shri Pran Nath, B.Sc. (Hons), (Ag.), Assoc. I.A.R.I.	do.
Shri Gurcharan Singh, D/Manager, B.VSc. Vety. Graduate	do.
Shri M.L. Bhardwaj, B.A. (Hons), M.A. (Eco.)	do.
Shri S.L. Pandey, B.Sc. (Ag.), Assoc. I.A.R.I.	do.
Shri Niranjan Singh, B.Sc. (Ag.), Assoc. I.A.R.I.	do.
Shri R.B.L. Bhardwaj, B.Sc. (Ag.), Assoc. I.A.R.I.	do.
Shri R.P. Mehta, M.A. (Math.)	do.
Shri Sharwan Kumar, M.A. (Math and Eco.)	do.
Dr. G.P. Gupta , M.Sc. (Ag.), D. Phil.	do.
Dr. R.C. Sethi, F. Sc. (Medical), L.V. Sc.	do.
Shri Ranbir Singh, B.Sc. (Hons), (Ag.), Assoc. I.A.R.I.	do.

Central College of Agriculture

Name	*Designation*
Shri S.L. Chowdhury, B.Sc. (Ag.), M.A. (Eco.) Assoc. I.A.R.I.	Demonstrator
Shri G.D. Dureja, B.Sc. (Ag.)	do.
Shri. K.S. Parasher, M.Sc. (Ag.) Agro.	do.
Shri Ajit Singh, B.Sc. (Ag.), Assoc. I.A.R.I.	do.
Shri D.N. Thakur, Matric	Senior Scientific Assistant
Shri Trilok Singh, B.Sc.	do.

Name	*Designation*
Shri S.S. Chawla, B.Sc. (Ag.)	Senior Scientific Assistant
Shri Amar Jit Singh, B. Sc. (Hons) (Ag.)	do.
Shri Kahan Singh, B.Sc. (Ag.)	do.
Shri Alfred Ram, Matric, 2 year's Diploma in Agriculture	do.
Division of Botany	
Dr. S.M. Sikka, B.Sc., Ph. D. (London). Assoc. I.A.R.I.	Head of the Division
Dr. R.D. Asana, M.Sc., Ph. D. (London), D.I.C (London)	Plant Physiologist
Dr. G.S. Murty, M. Sc , Ph. D. (Minn), Assoc. I.A.R.I.	Wheat Breeder
Dr. A.B. Joshi, M.Sc., Ph. D. (Cantab), Assoc. I.A.R.I.	Geneticist
Shri H.B. Singh, M.Sc. Assoc. I.A.R.I.	Vegetable Breeder
Dr. M.S. Swaminathan, B.Sc., (Agri.), Ph. D (Cantab) Assoc. I.A.R.I.	Cytogeneticist
Dr. S.P. Kohli, M.Sc., Ph. D. (Cornell)	Geneticist
Shri R.B. Deshpande, M. Ag. (Distinction), Assoc. IARI.	do.
Dr. N.L. Dhawan, M.Sc., Ph.D. (Minn), Assoc. I.A.R.I.	Seed Testing Officer
Shri T.J. Malkani, M.Sc.	Assistant Plant Physiologist
Shri M.D. Nandkeolyar, M.Sc. (Agri)	Superintendent, (B.S.S., Pusa)
Shri Kedar Nath, M.A., M.Sc.	Assistant Wheat Breeder
Shri S.S. Rajan, M.Sc.	Assistant Cytogeneticist
Shri V.S. Mathur, M.Sc.	Assistant Wheat Breeder
Shri V.K. Srinivasan, M.Sc.	do.
Shri B.S. Fozdar, B.Sc. (Ag.), M.Sc (Botany)	Lecturer C.C.A.
Shri V.S. Mani, M.Sc.	Assistant Plant Physiologist
Shri S.P. Mital, B.Sc. (Ag.), M.Sc. (Botany), Assoc. I.A.R.I.	Assistant Botanist
Shri Amir Singh, M.Sc.	do.
Shri S. Ramanujan, B.Sc., (Hons.), Assoc. I.A.R.I.,	Assistant Cytogeneticist
Dr. H.K. Jain, B.Sc. (Hons.), Assoc. I.A.R.I, Ph. D. (Wales)	do.
Shri M.W. Hardas, M.Sc., Assoc. I.A.R.I.	do.
Shri Vishnu Sarup, M.Sc., Assoc. I.A.R.I.	do.
Shri M.V. Rao, M.Sc. (Ag.)	Assistant Wheat Breeder
Shri Y.M. Upadhyaya, B.Sc. (Hons), Assoc. I.A.R.I.	do.
Shri B.S. Joshi, B.Sc. (Ag.), Assoc. I.A.R.I.	Assistant Botanist
Shri L.M. Jaswani, B.Sc. (Ag.) Assoc. I.A.R.I.	do.
Shri Daljit Singh B.Sc., Assoc. I.A.R.I.	Assistant Statistician
Shri G.S. Venkataraman, M.Sc.	Assistant Botanist
Shri S.P. Singh, B.Sc. (Ag.)	Assistant Plant Physiologist
Shri R.K. Mehta, B.Sc., Assoc. I.A.R.I.	Assistant Geneticist
Shri P.M. Bhagchandani, B.Sc., (Ag.) Assoc. I.A.R.I.	Assistant Botanist
Shri M.G. Joshi, B.Sc. (Ag.), Assoc. I.A.R.I.	do.
Shri S.A. Dadlani, B.Sc. (Ag.)	Research Assistant
Shri R.K. Chatterjee, M.Sc.,	do.
Shri S.C.S. Mann, B.Sc. (Ag.), Assoc. I.A.R.I.	do.
Shri Milki Ram, B.Sc. (Ag.)	do.
Shri P.L.N. Somayajulu, B.Sc., Assoc. I.A.R.I.	do.
Shri J.S. Bakshi, M.Sc.	do.
Shri H.B. Bhatia, B.Sc. (Ag.)	do.
Shri Manmohan Auluwalia, B.Sc. (Hons), Assoc. I.A.R.I.	do.
Shri S.M. Vaidya, B.Sc. (Ag.) Assoc. I.A.R.I.	do.
Shri S.C.S. Pokhriyal, M.Sc. (Agr.) Assoc. I.A.R.I.	do.
Shri M.A. Vishwanathan, B.Sc. (Ag.), Assoc. I.A.R.I.	do.
Shri K.R. Srikantia, B.Sc., Assoc. I.A.R.I.	do.
Shri Karambir Singh, M.Sc. (Ag.)	do.
Shri Ved Parkash, M.Sc. (Botany)	do.
Shri V.K. Pathak, M.Sc., Assoc. I.A.R.I.	do.

INDIAN AGRICULTURAL RESEARCH INSTITUTE—*(Contd.)*

Name	*Designation*
Shri M.P. Singh, M.Sc. (Hons.)	Research Assistant
Shri A.T. Natrajan, M.Sc., Assoc. I.A.R.I.	do.
Shri A.T. Ganesan, M.A. (Botany)	do.
Shri P.N. Bahal, B.Sc. (Ag.)	do.
Shri D. Jagthesan, M.Sc. (Botany)	do.
Shri A.D. Saini, M.Sc. (Botany), Assoc. I.A.R.I.	do.
Shri K.B.L. Jain, B.Sc. (Ag.) (Hons.), Assoc. I.A.R.I.	do.
Shri R.A. Pai, M.Sc. (Botany)	do.
Shri S.N. Kakar, M.Sc. (Botany)	do.
Shri P.N. Rao, B.Sc. (Ag.), Assoc. I.A.R.I.	do.
Shri Joginder Singh, B.Sc. (Ag.), Assoc. I.A.R.I.	do.
Shri B.H. Mathai, M.Sc. (Ag.), Assoc. I.A.R.I.	do.
Shri P.N.N. Nahisan, M.Sc.	do.
Shri R.K. Agarwal, M.Sc. (Botany), Assoc. I.A.R.I.	do.
Miss Sulbha Kumari, M.Sc. (Botany)	do.
Shri J.S. Dhillon, M.Sc. (Ag.)	do.
Shri B.C. Joshi, M.Sc. (Botany)	do.
Shri K.V. Satyanarayana, M.Sc. (Botany)	do.
Shri T.A. Thomas, M.Sc. (Botany)	do.
Shri S.G. Ahire, B.Sc., (Ag.), Assoc. I.A.R.I.	do.
Shri Thamby Ninan, M.Sc. (Botany)	do.
Shri Joginder Nath, M.Sc., (Hons.) Botany	do.
Shri K.R. Chopra, M.Sc. (Ag. Botany)	do.
Shri B. Narsinha Murty, M.Sc.	do.
Shri H.K. Saxena, M.Sc. (Botany)	do.
Shri D.J. Singh, M.Sc.	do.
Shri P.P. Khanna, M.Sc. (Botany)	do.
Shri N. Dutta, M.Sc. (Botany)	do.
Shri K.V. Natrajan, M.Sc. (Botany)	do.
Shri Sewa Singh, B.Sc. (Ag.)	Senior Scientific Assistant
Shri T.R. Dayani, B.Sc. (Ag.)	do.
Shri K.L. Sethi, M.A.	do.
Shri D.P. Chopra, B.Sc. (Ag.)	do.
Shri P.S. Gupta, B.Sc.	do.
Shri Basant Kumar, B.Sc. (Ag.)	do.
Shri P.L Guglani, B.A.	do.
Shri P.N. Wattal, B.Sc. (Bot. and Chemistry)	do.
Shri Pran Nath, B.A.	do.
Shri M.B.L. Saxena, M.Sc. (Botany)	do.
Shri Bhubneshwar Parshad, B.Sc.	do.
Shri N. Gupta, B.Sc., (Hons.) (Botany)	do.
Shri Rajpal Puri, B.Sc.	do.
Shri S.R. Rao, B.Sc. (Botany)	do.
Shri V.P. Tewari, B.Sc.	do.

Division of Horticulture

Dr. G.S. Randhawa, M.Sc. M.S.A. (Toronto) Canada, Ph.D. (Mich) U.S.A., F.R.H.S. (London)	Horticulturist
Dr. B. Choudhury, B.Sc. (Agri.), Ph. D. (Melbourne), F.R.H.S.	Vegetable Breeder
Shri Romesh Chander, B.Sc. (Agri.)	Garden Superintendent
Dr. Jagpal Singh, M.S. (Agri.) Ph. D. (Mich. St.)	Assistant Horticulturist
Shri N. Nath, B.Sc., M.Sc. (Cal.)	Lecturer in Hort. (C.C.A.)
Shri R.S. Malik, M.Sc.	Research Assistant
Shri V.S. Seshadri, M.Sc.	do.

Name	*Designation*
Division of Soil Science and Agricultural Chemistry	
Dr. S.P. Raychaudhuri, B.Sc. (Hons.), M.Sc., Ph. D. (Lond), D.Sc., F.R.I.C., F.N.I.	Head of the Division
Dr. R.V. Tamhane, B.Sc. (Ag.), Ph. D. (London)	Special Officer, Soil Testing
Dr. C. Dakshinamuthy, Ph. D. (London), D. Sc. (Banaras), F.I.P.	Senior Physicist
Dr. N.B. Das, Ph. D. (Chem)	Biochemist
Dr. K.C. Gulati, M.Sc., Ph.D.	Organic Chemist
Dr. N.P. Dutta, B.Sc. (Hons.), M.Sc., D. Sc. A.R.I.C.	Soil Scientist
Shri L.M. Mathur, M.A.B.T.	Cartographer
Dr. B. Ramamoorthy, M.Sc., D. Phil., Assoc. I.A.R.I.	Physical Chemist
Dr. Y.V. Kathavate, M.Sc., Ph. D.	Experimental Physicist
Dr. K.V.S. Satyanarayana, B.Sc. (Ag.), Assoc. I.A.R.I., Ph. D.	Soil Correlator
Dr. S.V. Govindarajan, B.Sc. (Hons), Ph.D., D.I.C.	do.
Dr. B.B. Roy, M.Sc., Ph.D., A.R.I.C.	do.
Shri Sasadhar Digar, M.Sc., Dip. Agri.	do.
Dr. G.S. Krishna Rao, M.Sc., Ph. D., A.I.I.Sc., D.I.I.Sc.	Chemist
Dr. W.V.B. Sundra Rao, M.Sc. (Hons) Ph.D., Assoc. I.A.R.I.	Lecturer
Shri M.A. Idnani, B.Sc. (Hons.) Assoc. I.A.R.I.	Assistant Agricultural Chemist
Dr. B.T. Mulwani, B.Ag., M.Sc., Ph.D. (Lond.)., D.I.C. (Lond.)	Assistant Soil Physicist
Dr. A.R.S. Kartha, Ph.D. (Madras)	Assistant Organic Chemist
Dr. Abhiswar Sen, M.Sc., Ph. D., Assoc. I.A.R.I.	Assistant Soil Microbiologist
Dr. B.V. Subbiah, M.Sc., Ph. D.	Assistant Soil Chemist
Shri R.S. Murthy, M.Sc.	Assistant Survey Officer
Dr. Brij Mohan Lal, M.Sc., Ph. D.	Assistant Biochemist
Shri A.B. Ghosh, B.Sc. (Hons.) M. Sc.	Assistant Soil Chemist
Dr. T.D. Biswas, B.Sc. (Hons.), M.Sc., D. Phil.	Assistant Soil Survey Officer
Shri S.C. Mehta, M.Sc.	Assistant Physicist
Dr. S.C. Das, M.Sc., D. Phil (Cal), Ph. D. (Leeds)	Assistant Physical Chemist
Shri R.S. Dewan, M.Sc.	Assistant Chemist
Shri P.K. Oommen, M.Sc.	Assistant Soil Chemist
Shri H.G. Gopala Rao, M.Sc.	do.
Shri B.B. Rudra, M.Sc., Assoc. I.A.R.I.	do.
Shri T.R. Srinivasa, B.Sc., Assoc. I.A.R.I.	do.
Shri Y.P. Bali, B.Sc., Assoc. I.A.R.I.	do.
Shri P.M. Joshi, B.Sc., Assoc. I.A.R.I.	do.
Shri Bhagwan Das, M.Sc.	do.
Shri V.K. Mishra, B.Sc., Assoc. I.A.R.I.	do.
Shri U.C. Padhi, B.Sc. Assoc. I.A.R.I.	do.
Shri N.G. Perur, M.Sc.	do.
Shri K.L. Nayar, M.Sc.	do.
Shri N.R. Datta Biswas, M.Sc.	do.
Shri P.C. Thakur, B.Sc., Assoc. I.A.R.I.	do.
Shri H.S. Suhramoney, M.Sc.	do.
Shri S.P. Seth, M.Sc. (Hons.)	Research Assistant
Shri R.M. Banerjee, B.Sc.	do.
Shri V. Ishwaran, M.Sc.	Demonstrator
Shri K.B. Shome, M.Sc.	Research Assistant
Shri R.K. Chatterji, B.Sc. (Hons,) M.Sc.	do.
Shri B.Das, M.Sc.	do.
Shri A.N. Sen, M.Sc.	do.
Shri M.B. Sen Gupta, M.Sc.	do.
Shri A.S. Sethi, B.Sc., M.Sc.	do.
Shri N.M. Nimgade, B.Sc. (Ag.), Assoc. I.A.R.I.	do.
Shri S.P. Duggal, B.Sc.	do.
Shri R. Narayanan, M.Sc.	do.

Name	*Designation*
Shri N.B. Paul, B.Sc., Assoc. I.A.R.I.	Research Assistant
Shri R.K. Chhibber, B.Sc. (Ag.), Assoc. I.A.R.I.	do.
Shri S.P. Jain, B.Sc., Assoc. I.A.R.I.	do.
Shri O.P. Chawla, M.Sc. (Ag.)	do.
Shri A.K. Rishi, B.Sc., Assoc. I.A.R.I.	do.
Shri Srivastava Syamacharan, M.Sc.	do.
Shri V.N. Sant, M.Sc.	do.
Shri N.R. Dutta, B.Sc., Assoc. I.A.R.I.	do.
Shri Gurbachan Singh, M.Sc.	do.
Shri R.C. Misra, B.Sc., Assoc. H.B.T.I.	do.
Shri K. Rajgopalan, B.Sc. (Ag.), Assoc. I.A.R.I.	Soil Survey Assistant
Shri O.P. Dhamija, B.Sc. (Hons.) , Ag. Assoc. I.A.R.I.	do.
Shri M.S. Khera, B.Sc. (Ag.), Assoc. I.A.R.I.	Research Assistant
Shri Baldev Kapoor, M.Sc. (Hons.)	do.
Shri N.K. Shinde, B.Sc. (Ag.), Assoc. I.A.R.I.	Soil Survey Assistant
Shri Y.P. Gupta , B.Sc., Assoc. I.A.R.I.	Research Assistant
Shri R.B. Rewari, B.Sc. (Hons.), Assoc. I.A.R.I.	Soil Survey Assistant
Shri G. Ramchandra, M.Sc., Assoc. I.A.R.I.	Research Assistant
Shri R.P. Dhir, B.Sc. (Ag.), Assoc. I.A.R.I.	Soil Survey Assistant
Shri H.M. Basabanna, B.Sc. (Ag.), Assoc. I.A.R.I.	do.
Shri R.J. Landey, B.Sc. (Ag.), Assoc. I.A.R.I.	do.
Shri Kamlesh Chandra Mazumdar, B.Sc.	do.
Shri N.K. Barda, B.Sc. (Ag.)	do.
Shri A.S. Gowaikar, B.Sc. (Ag.)	do.
Shri Rajaram Shankar, B.Sc. (Ag.)	do.
Shri A.E. Vasudeva Rao, M.Sc.	do.
Shri G.P. Biswas, M.A.	do.
Shri L.S. Bisht, M.A.	Cartographic Assistant
Shri K.G. Choudhuri, B.Sc.	Senior Scientific Assistant
Shri M.B. Kamath, B.Sc.	do.
Shri K.C. Sikka, B.Sc.	do.
Shri G.K. Barat, B.Sc.	do.
Shri S.N. Datta, B.Sc. (Hons.)	do.
Shri J.C. Bajaj, B.Sc. (Hons.)	do.
Shri H.K. Gupta, B.Sc.	do.
Shri P.C. Ghosh, B.Sc.	do.
Shri Man Mohan Singh, Anand, B.Sc.	do.
Shri Ramji Lal, B.Sc.	do.
Shri T.R. Saini, Matric	do.
Shri Dharambir Singh, B.Sc.	do.
Shri K.K. Oberoi, B.Sc.	do.
Shri S.K. Chatterjee, B.Sc.	do.

Division of Entomology

Dr. E.S. Narayanan, M.A. (Zoology), Ph. D.(London)(Entomology), D.I.C., F.R.E.S., F.E.S.I., F.A. Sc.	Head of the Division of Entomology
Dr. S. Pradhan, B.Sc. (Hons.) M.Sc., Ph. D. (Lond.) D.Sc., F.R.E.S., F.E.S.I.,	Insect Toxicologist
Dr. M.G. Ramdas Menon, B.Sc., Ph. D. (Bombay)	Systematic Entomologist
Dr. N.C. Pant, M.Sc. (Agri.), Ph.D. (Lond.), D.I.C.	Insect Physiologist
Dr. Rattan Lal, B.Sc. (Hons.), M.Sc. (Hons.), Ph.D. F R.E.S., F.E.S.I., Assoc. I.A.R.I.	Entomologist Radio Tracer Studies
Dr. B.K. Srivastava, M.Sc. (Ag.), Ph. D. (Kansas)	Entomologist Seed Testing
Shri H.N. Batra, B.Sc. (Agri.), Assoc. I.A.R.I.	Assistant Ecologist
Shri S.M. Chatterjee, M.Sc., Assoc. I.A.R.I, F.R.E.S., F.A.Z.	Assistant Systematic Entomologist

Name	*Designation*
Shri P.B. Mookerjee, B.Sc. Assoc. I.A.R.I.	Assistant Entomologist
Shri M.G. Jotwani, B.Sc. (Hons.), Assoc. I.A.R.I.	do.
Dr. B.R. Subba Fao, B.Sc. (Hons), Assoc. I.A.R.I, Ph. D. (Mys.), F.A.Z.	do.
Dr. H.J. Bhambhani, B.Sc., Ph. D. (Lond.), Assoc. I.A.R.I.	do.
Shri Y.P. Beri, B.Sc. (Agric.), M. Agric. Sc. (Australia)	do.
Shri P.L. Sharma, M.Sc. Ag.	do.
Shri M.G. Chacko, M.Sc., Assoc. I.A.R.I.	Research Assistant
Shri Kundan Lal, M.Sc. (Hons.)	do.
Shri H.D. Vasu, M.Sc. (Entomology)	do.
Shri K.M. Peswani, B.Sc. (Agri), Assoc. I.A.R.I.	do.
Shri J.K. Nayar, M.Sc. (Zoology)	do.
Dr. D.P. Srivastava, M.Sc., D. Phil.	do.
Shri Prakash Sarup, M.Sc., Assoc. I.A.R.I.	do.
Miss Swaraj Ghai, M.Sc. (Zoology)	do.
Shri J. Gopala Krishna, M.Sc. (Ag.), Assoc. I.A.R.I.	do.
Shri Saran Singh, M.Sc. (Hons.), Assoc. I.A.R.I.	do.
Shri S.K. Bhatia, M.Sc., Assoc. I.A.R.I.	do.
Shri S. Raj Wadhi, M.Sc.	do.
Shri Baldev Prashad, M.Sc., Assoc. I.A.R.I.	do.
Shri Bhupender Kumar Rai, B.Sc. (Hons.) (Agr.), Assoc. I.A.R.I.	do.
Shri G.R. Sethi, M.Sc. (Zoology)	do.
Shri G.R. Sharma, B.Sc. (Agri)	do.
Shri M.K. Krishna Pillai, M.Sc.	do.
Shri Ramachandra Rao, B.Sc. (Ag.), Assoc. I.A.R.I.	do.
Shri H.S. Sangwan, B.Sc. (Hons.) (Ag.), Assoc. I.A.R.I.	do.
Shri R.N. Katiyar, M.Sc. (Agri)	do.
Shri G.W. Rahalkar, M.Sc. (Zoology)	do.
Shri P.N. Saxena, M.Sc.	do.
Shri A.K. Sharma, M.Sc., Assoc. I.A.R.I.	do.
Shri G.C. Sharma, B.Sc. (Hons.) (Ag.), Assoc. I.A.R.I.	do.
Miss R.B. Kaur, M.Sc.	do.
Shri K.G. Phadke, M.Sc.	do.
Shri M.T. Joseph, M.Sc.	Senior Scientific Assistant
Shri N. Bhattacharji, B.Sc. (Ag.)	do.
Shri S.C. Chopra, B.Sc. (Hons.) (Agri.)	do.
Shri Krishan Kumar, B.Sc.	do.
Shri G.K. Girish, B.Sc.	do.
Shri Dan Singh, B.Sc.	do.
Miss Prakash Gupta, M.Sc. (Zoology)	do.

Division of Mycology and Plant Pathology

Dr. R.S. Vasudeva, Ph. D. (Lond.) D. Sc. (Lond.) D.I.C., F.N.I.	Head of the Division
Dr. B.L. Chona, Ph. D. (London), D.I.C. (London)	Systematic Mycologist
Dr. R. Prasada, M.Sc., D.Sc. (Agra)	Mycologist
Shri P.M. Varma, B.Sc. (Hons.), M.Sc.	Virus Entomologist
Dr. S.P. Capoor, M.Sc., Ph. D. (Lond.)	Virus Pathologist
Dr. M.K. Hingorani, Ph. D. (Minnesota), Assoc. I.A.R.I.	Plant Bacteriologist
Dr. S.P. Raychaudhuri, M.Sc., D. Phil, F.L.S., Assoc. I.A.R.I	Virus Pathologist
Dr. D. Suryanarayana, M.Sc., D.Sc. (Agra)	Plant Pathologist
Shri Ram Lal Kunjal, M.Sc.	Mycologist
Dr. M.L. Sattani, M. Sc., Ph. D. (Minnesota)	Assistant Plant Pathologist
Shri V.C. Lele, M.Sc.	Assistant Mycologist
Shri R.N. Azad, B.Sc. (Ag.), Assoc. I.A.R.I.	Assistant Virus Pathologist
Shri L.M. Joshi, M.Sc.	Assistant Mycologist

INDIAN AGRICULTURAL RESEARCH INSTITUTE—(Contd.)

Name	Designation
[illegible]	Assistant Virus Pathologist
[illegible]	Assistant Plant Pathologist
[illegible]	Lecturer in Mycology
[illegible]	Assistant Plant Pathologist
[illegible]	Assistant Virus Pathologist
[illegible]	Assistant Mycologist
[illegible]	Assistant Mycologist
[illegible]	Assistant Virus Pathologist
[illegible]	Herbarium Keeper
[illegible]	Virus Entomologist
[illegible]	Research Assistant
[illegible]	Do.
[illegible]	Do.
[illegible]	Do.
[illegible]	Do.
[illegible]	Do.
[illegible]	Do.
[illegible]	Do.
[illegible]	Do.
[illegible]	Do.
[illegible]	Do.
[illegible]	Do.
[illegible]	Do.
[illegible]	Do.
[illegible]	Do.
[illegible]	Do.
[illegible]	Do.
[illegible]	Do.
[illegible]	Do.
[illegible]	Photographer
[illegible]	Research Assistant
[illegible]	Do.
[illegible]	Do.
[illegible]	Senior Scientific Assistant
[illegible]	Do.
[illegible]	Do.
[illegible]	Do.
[illegible]	Do.

Division of Agricultural Engineering

Name	Designation
[illegible]	Officer-in-Charge, Division of Agricultural Engineering
[illegible]	Mechanical Engineer
[illegible]	Assistant Engineer
[illegible]	Research Assistant
[illegible]	Do.
[illegible]	Workshop Foreman
[illegible]	Assistant Foreman
[illegible]	Senior Scientific Assistant

CENTRAL RICE RESEARCH INSTITUTE

Cuttack (Orissa)

Name	*Designation*
Shri R.L.M. Ghose, M.Sc., F.A.Sc.	Director
Agronomy Division	
Dr. M.V. Vachhani, B.Ag., Ph.D.	Agronomist
Shri M.B. [illegible], B.Sc. (Agri.), Asso. I.A.R.I.	Research Assistant
Shri M.V. Rao, B.Sc. (Agri.)	do.
Shri K. [illegible] Murty, M.Sc.	do.
Botany Division	
Shri R.L.M. Ghose, M.Sc., F.A.Sc.	Geneticist and Botanist
Shri S. Sampath, M.A.	Cytologist
Shri M.B. [illegible], M.Sc., Asso. I.A.R.I.	Assistant Botanist
Shri [illegible], M.Sc.	Research Assistant
Shri K. [illegible], M.Sc.	do.
Shri C. [illegible], M.Sc.	do.
Shri D.V. [illegible], M.Sc.	do.
Chemistry Division	
Dr. C.T. Abichandani, M.Sc., Ph.D.	Agricultural Chemist
Shri S. Patnaik, M.Sc.	Research Assistant
Shri R.R. [illegible], M.Sc.	do.
Entomology Division	
Shri P. Israel, M.A., F.R.E.S.	Entomologist
Shri G. [illegible], M.A., Asso. I.A.R.I.	Research Assistant
Shri Y.S. Rao, M.Sc.	do.
Plant Pathology Division	
Shri S.Y. Padmanabhan, M.A. Asso. I.A.R.I.	Mycologist
Dr. Durgadas Ganguly, M.A., D. Phil.	Assistant Mycologist
Statistics Division	
Shri M.P. Jha, M.Sc.	Statistician
Farm Division	
Shri M. [illegible] Pillai, B.A., B.Sc. (Agri.)	Farm Superintendent
Shri [illegible], B.Sc. (Agri.)	Research Assistant
Scheme for co-operation in rice research with rice growing States	
Shri [illegible], B.Sc. (Agri.)	Liaison Officer
Shri [illegible], B.Sc. (Agri.)	do.
Shri M.V.S. Sastry, M.Sc.	Research Assistant
Shri [illegible] Patnaik, M.Sc.	do.
Shri J. [illegible] Raghavan, M.Sc.	do.
Shri [illegible], B.Sc. (Ag.), Asso. I.A.R.I.	do.
Indian Council of Agricultural Research Schemes	
Dr. S. [illegible], M.Sc., Ph.D.	Assistant Botanist
Shri M.J. [illegible] Rao, M.Sc.	Research Assistant
Shri T.R. [illegible], M.Sc.	do.
Shri P. [illegible] Rao, M.Sc.	do.

CENTRAL POTATO RESEARCH INSTITUTES

1. CENTRAL POTATO RESEARCH INSTITUTE, SIMLA

Name	*Designation*
Botany	
Dr. Pushkarnath, M.Sc., Ph.D., Assoc. I.A.R.I.	Director
Shri M.L. Khanna, B.Sc. (Ag.), Assoc. I.A.R.I.	Botanist
Shri K.P. Sharma, M.Sc., Assoc. I.A.R.I.	Research Assistant
Shri K.K. Batra, B.Sc. (Hons.)	do.
Cytogenetics	
Dr. D. Srinivasachar, M.Sc., Ph.D. (Wis), Assoc. I.A.R.I.	Cytogeneticist
Shri R.S. Dwivedi, M.Sc. (Agri.)	Research Assistant
Plant Pathology	
Shri B.L. Dutt, M.Sc. (Hons.)	Virus Pathologist
Dr. C.S. Ramamurthi, M.Sc., (Hons), Ph.D. (Cora), Assoc. I.A.R.I.	Assistant Plant Pathologist
Shri B. Ganguly, B.Sc. (Ag.), Assoc. I.A.R.I.	Research Assistant
Plant Physiology	
Dr. Rajat De, M.Sc., Ph.D.	Plant Physiologist
Shri S.C. Verma, M.Sc.	Research Assistant
Statistics	
Shri M.S. Singal, B.A. (Hons.), Assoc. I.S.I.	Statistician

2. CENTRAL POTATO RESEARCH STATION, PATNA

Botany	
Shri M.J. Deshmukh, M.Sc., Assoc. I.A.R.I.	Assistant Botanist
Shri S.K. Anand, B.Sc. (Agri.)	Research Assistant
Agronomy	
Dr. Mukhtar Singh, M.Sc., Ph.D. (Edin)	Agronomist
Shri H.N. Akhade, B.Sc., Assoc. I.A.R.I.	Research Assistant
Shri R.R. Choudhary, M.Sc. (Agri.)	do.
Plant Pathology	
Dr. K.D. Paharia, M.Sc., Ph.D.	Plant Pathologist
Shri V.C. Gupta, M.Sc. (Ag.)	Research Assistant
Entomology	
Dr. K.K. Nirula, M.Sc. (Hons.), Ph.D., Assoc. I.A.R.I.	Agri. Entomologist
Shri C.L. Jolly, M.Sc.	Research Assistant
Chemistry	
Shri K. Swaminathan, B.Sc. (Hons.)	do.
Agricultural Engineering	
Shri D.N. Zutshi, B.Sc. (Ag.), Dip. G.M.I.	Agri. Engineer

3. POTATO BREEDING AND CERTIFICATION STATION, KUFRI

Shri P.N. Mathur, M.Sc.	Assistant Botanist
Shri B.L. Barua, B.Sc. (Ag.), Assoc. I.A.R.I.	Research Assistant
Shri Pran Singh, B.Sc. (Ag.)	do.

CENTRAL POTATO RESEARCH STATIONS—(*Contd.*)

4. REGIONAL EXPERIMENTAL CENTRES

Name	*Designation*
Babugarh (*U.P.*)	
Shri G.T. Chhabria, B.Sc. (Ag.)	Research Assistant
Ootacamund (*Madras*)	
Shri K.R. Alwa, B.Sc. (Ag.)	do.
Poona (*Bombay*)	
Shri J.T. Karnani, B.Sc. (Ag.)	do.
Jullundur (*Punjab*)	
Shri Pritam Singh, B.Sc. (Ag.)	do.
Darjeeling (*West Bengal*)	
Shri B.N. Roy Choudhary, M.Sc.	do.

5. SEED MULTIPLICATION STATION, MUKTESHWAR

Name	*Designation*
Mukteshwar (*U.P.*)	
Shri M.B. Patkar, B.Sc., Assoc. I.A.R.I.	Seed Development Officer
Shri Raghbir Singh, M.Sc.	Research Assistant
Shri S.S. Saini, M.Sc.	do.

6. TUBER CROPS SECTION

Name	*Designation*
Patna Station (*Bihar*)	
Shri Hari Kishore, M.Sc., Assoc. I.A.R.I.	Assistant Botanist
Shri K.N. Chhibber, B.Sc. (Ag.)	Research Assistant

INDIAN VETERINARY RESEARCH INSTITUTE

Izatnagar (U.P.)

Name	*Designation*
Dr. N.D. Kehar, Sc. D.	Director
Animal Nutrition Division	
Dr. D.N. Mullick, M.Sc., Ph. D.	Research Officer (Physiology)
Dr. K. Sahai, M.Sc., Ph. D.	Assistant Research Officer (Training)
Dr. B.N. Majumdar, M.Sc., Ph. D.	Assistant Research Officer (Biochemistry)
Officers in the Schemes	
Dr. S.N. Ray, M.Sc., Ph. D.,	Research Officer (Trace Element)
Dr. R. Mukherjee, M.Sc., Ph. D.	Research Officer (Paddy Straw)
Shri Brahm Dutt, B.A., L.V.P.,	Assistant Research Officer (Trace Element)
Dr. P.C. Sawhney, M.Sc., Ph .D.	Assistant Research Officer (Urea)
Biological Products Division	
Shri C. Seetharaman, B.Sc , G.M.V.C., B.V.Sc. (M.Sc. (Vety.)	Head of Division
Dr. T.S. Gulrajani, Ph. D.	Research Officer (Vaccine)
Shri K.C. Sinha, G.B.V.C.,	Research Officer (Rinderpest Vaccine)
Shri B.M. Thakral, L.V.P.	Research Officer (Sera)
Shri D.R. Uppal, B.A. G.B.V.C.	Assistant Research Officer (Goat Tissue Vaccine)
Shri Gopal Rai, G.P.V.C.	Assistant Research Officer (Sera)
Shri S.S. Jawa, L.V.P. (Hons)	Assistant Research Officer (Product Testing Virus Vaccine)
Shri S.S. Khera, B.V.Sc.	Assistant Research Officer (Bacterial Vaccine)
Animal Genetics Division	
Dr. P. Bhattacharya, M.Sc., Ph. D.	Head of Divison
Shri Gajjan Singh, B.V. Sc., G.M.V.C.	Assistant Research Officer (Artificial Insemination)
Shri S.V. Chandiramani, B.Sc. (Agri.) M.S.	Assistant Research Officer (Genetics)
Dr. S.R. Guha, Ph. D.	Assistant Research Officer (Climatology)
Officers in the Schemes	
Dr. S.S. Prabhu, Ph. D.	Research Officer (Quantitative Inheritance)
Dr. D.P. Mukherjee, M.Sc. , Ph. D.	Research Officer (Draught Capacity)
Shri S.N. Luktuke, G.B.V.C.	Research Officer (Sterility)
Shri S.N. Chatterjee, G.V.Sc.,	Assistant Research Officer (Sterilisation)
Shri Chet Ram, G.V. Sc.,	Assistant Research Officer (Immunogenetics)
Poultry Research Division	
Shri S.G. Iyer, G.M.V.C.	Head of Division
Capt. S.B.V. Rao, L.V.P. (Hons.)	Research Officer (Pathology)
Dr. S. Bose, Ph. D.	Research Officer (Farm)
Dr. V.N. Murty, M.Sc., Ph. D.	Assistant Research Officer (Biochemistry)
Dr. T. D. Mahadevan, Ph. D.	Assistant Research Offieer (Poultry Technology)
Dr. A K. Pal, M. Sc., Ph. D	Assistant Research Officer (Training)
Shri H.P. Tandon, L.V.P. (Hons.) B.V. Sc.,	Assistant Research Officer (Poultry)
Parasitology Division	
Dr. H.D. Srivastava, D.Sc.	Head of Division
Dr. R.P. Chaudhary, M. Sc., Ph.D.	Research Officer (Entomology)
Shri B.N. Soni, B.Sc. (Agri.) (Edin)	Research Officer (Hides and Skins)
Dr. C.T. Peter, M.Sc. (Vety.), Ph. D.	Assistant Research Officer (Helminthology)
Dr. S.C. Dutt, M.Sc., Sc. D.	Assistant Research Officer (Helminthiasis)
Shri B.S. Gill, M.V. Sc.	Assistant Research Officer (Protozoology)

Name	*Designation*
Officers in the Scheme	
Dr. P.G. Deo, M.Sc., Ph. D.	Assistant Research Officer (Helminthic Aspects)
Pathology and Bacteriology Division	
Shri M. R. Dhanda, L.V.P., M.S. (Michi)	Head of Division
Shri J.M. Lal, L.V.P (Hons)	Research Officer (T B and J D)
Shri M.S. Menon, I.D.D., G.V.Sc.	Research Officer (Rinderpest)
Shri P.R. Nilakantan, G.M.V.C., B.V. Sc.	Research Officer (Bacteriology)
Shri G.L. Sharma, L.V.P., M.S., Ph. D.	Research Officer (Pathology)
Shri H.S. Dhillon, B.A. L.V.P.	Assistant Research Officer (Rinderpest)
Shri Gajender Singh, B.Sc., L.V.P.	Assistant Research Officer (T.B. and T.D.)
Shri P.C. Gangulee, B.Sc., B.Sc. (Zoo), G.V. Sc.	Assistant Research Officer (Bacteriology)
Shri M.S. Jayaraman, G.M.V.C.,	Assistant Research Officer (Anaerobes)
Dr. S.S. Negi, M.Sc., Ph. D.	Assistant Research Officer (Biochemistry)
Officers in the Schemes	
Shri B.K. Kathuria, G.B.V.C.	Assistant Research Officer (Rabies)
Shri M.S Sethe, L.V.P.	Assistant Research Officer (Mastitis)

NATIONAL DAIRY RESEARCH INSTITUTE

Karnal (Punjab)

Name	*Designation*
Dr. K.K. Iya, Ph.D., A.I.I. Sc., I.D.D. (Hons.)	Director
Dr. N.N. Dastur, M.Sc., Ph.D., A.I.I. Sc.	Chemist
Dr. S.C. Ray, M.Sc., Ph.D.	Technologist
Dr. C.P. Anantakrishnan, M.Sc., Ph.D., F.R.I.C., A.I.I.Sc. A.M. Tech. (I) Gt. Brit.	Technologist
Dr. H. Laxminaryana, M.Sc., Ph.D.	Bacteriologist
Shri N.N. Simha, B.E.	Dairy Engineer
Dr. T.M. Paul, M.Sc., Ph.D., A.R.I.C. Art. Tech(I) Gt. Brit.	Assistant Dairy Chemist
Shri R.S. Singh, G.V.Sc., B.V.Sc., A.H., M.S. (U.S.A.)	Cattle Officer
Shri S.C. Kahai, B. Ag.	Agriculture Officer
Shri K.S. Gunnery, M.Sc.	Assistant Research Officer
Shri S.R. Jayashankar, M.Sc.	Research Tech. Assistant
Shri Joginder Singh, M.Sc. (Tech.)	do.
Shri O. Brave, M.Sc. (Agri.)	do.
Shri V. Lakshminarsimha, M.Sc.	do.
Shri Iqbal Nath, L.V.P.	Supervisor
Shri Anand Parkash Sharma, B.Sc. (Agri.)	Technical Assistant
Shri S.N. Sharma, I.D.D.	Supervisor
Shri C. Banjamin, I.D.D.	do.
Shri K.D. Law, I.D.D.	do.
Shri C.K. Thomas, I.D.D.	Technical Assistant

DAIRY SCIENCE COLLEGE, NATIONAL DAIRY RESEARCH INSTITUTE, KARNAL

Shri Ramesh Chander Chandan, M.Sc. (Hons.)	Lecturer (Chemistry)
Shri A.K. Banerjee, B.Sc. (Agri.) (Eng.)	Lecturer (Engineering)
Shri R.M. Tiwari, M.A.L.T.	Lecturer (English and Hindi)
Shri K.A. Abraham, B.Sc. (Agri.) (Engineering)	Demonstrator (Engineering)
Shri K.A. Sumitra, L. Ag., I.D.D.	Demonstrator (Animal Husbandry)
Shri I.N. Arora, B.Sc. (Agri.)	Demonstrator (Agriculture)
Shri R.A. Ramanujam, B.Sc.	Demonstrator (Chemistry)

SOUTHERN REGIONAL STATION OF THE NATIONAL DAIRY RESEARCH INSTITUTE, BANGALORE

Shri A.J. Lazarus, I.D.D., Cert. in Adv. A.H.	Officer In-charge
Shri J. Krishmurthy Vasantv, C.M.V.C., B.V.Sc.	Research Officer (Artificial Insemination)
Shri D. Narayan, I.D.D.	Superintendent
Dr. M.L. Mathur, M.Sc., Ph.d., A.R.I.C., A.I.A.R.I.	Assistant Research Officer (Animal Nutrition)
Shri D. Venkatappiah, M.Sc.	Assistant Dairy Chemist
Dr. Kerala Verma, M.Sc., Ph.D.	Assistant Research Officer
Shri L.P. Maruthamuthu, I.D.D.	Research Technical Assistant
Shri T.V. Arunachalam, I.D.D.	do.
Shri S.P. Thomas, I.D.D.	do.
Shri T.V. Kumar, B.V.Sc.	Technical Assistant
Shri M.R. Srinivasan, M.A., A.I.I.Sc.	Research Technical Assistant
Shri K.C. Nayar, M.Sc.	do.
Shri M.K. Sastri, B.A., I.D.D., A.I.D.R.I.	do.
Shri G.M. Azmatulla, I.D.D.	do.
Dr. V.K.N. Namburdripad, M.Sc., Ph.D.	Sanitizer Assistant
Shri R.A. Srinivasan, M.Sc.	Research Technical Assistant
Shri M.K. Krishna Iyengar, M.Sc., I.D.D.	do.
Shri Sukumar De, M.Sc., I.D.D.	do.
Shri N.B. Shroff, M.Sc.	do.
Shri S.N. Anantaramiah, M.Sc.	do.
Shri S.N. Ghosh, B.Sc.	do.
Shri S.R. Sampath, M.Sc.	do.
Shri K. Anantaswamy, I.D.D.	Supervisor
Shri M.V. Gundu Rao, I.D.D.	do.
Shri M.C. Mannar, I.D.D.	do.
Shri T.A. Narayanswamy, L.E.E.	Farm Engineer
Shri S. Sankaran, I.D.D.	Lab. Assistant
Shri M.N. Sarathy, I.D.D.	do.
Shri Keshavamurthy Rao, B.Sc.	do.

CENTRAL FISHERIES RESEARCH STATIONS

DEEP SEA FISHING STATION AND ICE AND COLD STORAGE PLANT, BOMBAY

Name	*Designation*
Shri K.F. Lilauwala, Marine Engineer B.O.T. Cert.	Superintending Engineer
Shri A.I. George, M.Sc.	Deputy Director
Shri S.P. Killekar, M.S. (U.S.A.)	Manager
Shri F.D'Mello, M.S. (U.S.A.)	Technologist
Shri S. Gupta, M.Sc.	Technical Assistant

CENTRAL INLAND FISHERIES RESEARCH STATION, CALCUTTA

Dr. B.S. Bhimachar, D.Sc., F.A.Sc., F.N.I.	Chief Research Officer
Dr. T.V.R. Pillay, M.Sc , Ph.D.	Research Officer
Shri Y.R. Tripathi, M.Sc.	do.
Dr. K.K. Sarojini, M.A., Ph.D.	do.
Shri S.M. Banerjee, M.Sc.	do.
Shri V.R. Pantulu, M.Sc.	Assistant Research Officer
Shri J.C. Malhotra, M.Sc.	Fisheries Training Superintendent
Miss Eva Mitra, M.A.	Research Assistant
Shri N.R.D.V. Thampuran, M.Sc.	do.
Shri N. Dutta, M.Sc.	do.
Shri A.K. Banerjee, I.Sc.	do.
Shri B.B. Bose, M.Sc.	do.
Shri R.D. Chakraborty, M.Sc.	do.
Shri M. Mydeen Kunju, M.Sc.	do.
Shri R.M. Bhowinch, B.Sc.	do.
Shri A.K. Naskar, M.Sc.	do.
Shri D.V. Pahwa, M.Sc.	do.
Shri H.R. Kandar, B.Sc.	Survey Assistant
Shri S.N. Dutta, B.Sc.	do.
Shri S.P. Singh, B.Sc.	do.
Shri C.B. Srivastava, M.Sc.	do.
Shri M.J. Bhagat, B.Sc.	do.
Shri A. Chowdhury, B.Sc.	do.
Shri K.P. Srivastava, B.Sc.	do.
Shri S. Deshmahapatra, B.Sc.	do.
Shri K. Misra, B.Sc.	do.
Shri S. Banerjee, M.Sc.	do.
Shri S. Jena, M.Sc.	do.
Shri D.D. Chakraborty, M.Sc.	Computor
Shri R. Balasubramanayam, B.Sc.	Assistant Fisheries Training Superintendent
Shri K.H. Alikunhi, M.Sc.	Research Officer (Cuttack)
Dr. M.T. Phillipose, M.S., M.Sc., Ph.D.	do.
Shri H.L. Chaudhuri, M.Sc.	Assistant Research Officer (Cuttack)
Shri V. Ramachandran, B.Sc.	Research Assistant (Cuttack)
Shri M.A. Vijayalakshaman, B.Sc.	do.
Shri S.B. Singh, B.Sc.	do.
Shri K.L. Shegal, M.Sc.	do.
Shri S. Patnaik, M.Sc.	do.
Dr. V.G. Jhingaran, M.Sc.	Research Officer (Balugaon)
Shri K.H. Sujan Singhani, B.Sc.	Research Assistant (Balugaon)
Shri P. Roy, B.Sc.	do.
Dr. M.P. Motwani, B.Sc., Ph.D.	Research Officer (Allahabad)
Shri A. David, M.Sc.	Assistant Research Officer (Allahabad)
Shri S.J. Karamchandani, B.Sc.	Research Assistant (Allahabad)
Shri B.N. Saigal, M.Sc.	do.
Shri A.K. Gorai, M.Sc.	Research Assistant
Shri M.K. Kutty, M.A.	do.

CENTRAL FISHERIES RESEARCH STATIONS—(*Contd.*)

Name	*Designation*
Shri H.P.C. Shetty, M.A., M.Sc.	Research Assistant
Shri S.N. Chatterjee, M.Sc.	do.
Shri K.V. Ayanger, M.Sc.	do.
Shri A.N. Ghosh, M.Sc.	do.

FISHERIES TECHNOLOGICAL STATION, COCHIN

Shri G.K. Kurian, M.Sc.	Assistant Director, Technology (Gear)
Shri A.T. Sharif, B.Sc.	Assistant Director, Offshore Fisheries Station, Cochin
Shri A.F.De'Mello, M.Sc.	Fishery Technologist
Shri Shrikant Pandurang Killekar, M.S. (U.S.A.)	Manager

Fisheries Extension Units

Shri K.N. Das, M.Sc.	Fisheries Extension Officer (Calcutta)
Shri K.V. Rao, M.Sc., L.T.	Fisheries Extension Officer (Mandapam)
Shri M. Peter Devasundam, M.A.	Assistant Fisheries Extension Officer (Mandapam)
Shri R.D. Chakrabarty, M.Sc.	Assistant Fisheries Extension Officer (Gauhati)
Shri S.J. Rajan, B.A.	Assistant Fisheries Extension Officer (Bhopal)
Shri H.G. Hingorani, B.Sc.	Assistant Fisheries Extension Officer (Allahabad)
Shri C.G. Krishnamurthi, M.Sc.	Assistant Fisheries Extension Officer (Hyderabad)
Shri K.B.L. Saxena, B.Sc. (Hons.), M.Sc.	Extension Assistant (Calcutta)
Shri M.L. Rastogi, M.Sc.	Extension Assistant (Gauhati)
Shri A. Ghosh, M.Sc.	Extension Assistant (Gauhati)
Shri M.A. Saieed, B.Sc.	Extension Assistant (Hyderabad)
Shri Madhusudan, M.Sc.	-do-
Shri K.K. Mahajan, M.Sc.	Extension Assistant (Allahabad)
Shri D.K. Kaushik, B.Sc.	Extension Assistant (Bhopal)

CENTRAL MARINE FISHERIES RESEARCH STATION, MANDAPAM

Dr. S. Jones, D.Sc., F.A.Sc., F.Z.S.I.	Chief Research Officer
Dr. R. Raghu Prasad, M.Sc., Ph.D.	Research Officer
Dr. H.L. Arora, M.Sc., Ph.D.	do.
Shri N.K. Velankar, M.A.	do.
Shri S.K. Banerji, M.A.	do.
Shri L.B. Pradhan, M.Sc.	do.
Dr. (Mrs.) F. Thivy, M.A., Ph.D.	Assistant Research Officer
Shri R. Viswanathan, M.A., M.Sc.	do.
Shri P.R. Sadasivan Tampi, M.Sc.	do.
Dr. Samuel V. Job, M.A., Ph.D.	do.
Shri S.V. Suryanarayana Rao, M.Sc.	do.
Dr. V. Krishna Pillai, M.Sc., Ph.D.	do.
Shri P.V. Kamasastry, M.Sc.	do.
Shri M.J. George, M.Sc.	do.
Shri K.V. Sekhran, M.Sc.	do.
Shri V. Balan, M.A.	Research Assistant
Shri S. Ramamurthy, M.A., M.Sc.	do.
Dr. P. Vijayaraghavan, M.Sc., Ph.D.	do.
Shri T. Tholasilingam, M.Sc.	do.
Shri C. Mukundan Menon, M.Sc.	do.
Shri M. Rajendranathan Nair, M.Sc.	do.
Dr. R. Prasanna Varma, M.A., Ph.D.	do.
Shri K. Krishna Rao, M.Sc.	do.
Shri T.K. Govindan, M.Sc.	do.
Shri Rajendra Mohan Dhawan, M.Sc.	do.
Shri K.N. Krishna Kartha, M.Sc.	do.
Shri P.K. Talwar, M.Sc.	do.

CENTRAL FISHERIES RESEARCH STATIONS—(*Contd.*)

Name	*Designation*
Shri A.V.V. Satyanarayana, B.Sc.	Survey Assistant
Shri A.P. Valsan, B.Sc.	Extension Assistant
Shri P.V. Ramachandran, B.Sc.	Research Assistant
Shri M.S. Muthu, M.A.	do.
Staff at Substations	
Shri R. Velappan Nair, M.Sc.	Research Officer (Vizag.)
Shri M. Krishna Menon, M.A., M.Sc.	Research Officer (Cochin)
Sri R. Jayaraman, M.A.	Assistant Research Officer (Bombay)
Dr. R. Subrahmanayan, M.Sc., Ph.D., F.R.M.S., F.P.S., F.A.Sc.	Assistant Research Officer (Kozhikode)
Shri G. Venkatraman, M.A.	do.
Dr. G. Seshappa, M.Sc., Ph.D.	Assistant Research Officer (Karwar)
Shri P.C. George, M.A.	Assistant Research Officer (Mangalore)
Shri L.R. Kasturiranjan, M.A., M.Sc., L.T.	Assistant Research Officer (Cochin)
Dr. A. Anantarama Sastry, D.Sc.	Assistant Research Officer (Cochin)
Shri V. Ramamohana Rao, M.Sc.	Research Assistant (Cochin)
Shri K.C. George, M.Sc.	Research Assistant (Cochin)
Shri S.V. Bapat, M.Sc.	Assistant Research Officer (Karwar)
Shri N. Radhakrishnan	Research Assistant (Karwar)
Shri M.S. Prabhu, M.Sc.	Assistant Research Officer (Bombay)
Shri D.M. Punwani, B.Sc.	Special Survey Assistant (Bombay)
Miss P.D. Nayak, M.Sc.	Research Assistant (Bombay)
Shri V.M. Deshmukh, M.Sc.	do.
Shri J.P. Karbhari, B.Sc.	Survey Assistant (Bombay)
Shri V.N. Bande, M.Sc.	do.
Shri K. Nagappan Nair, M.Sc.	Assistant Research Officer (Madras)
Shri B. Krishnamurthy, M.Sc.	do.
Shri Syed Basheeruddin, B.Sc.	Survey Assistant (Madras)
Shri P. Udaya Varma Thirupad, B.Sc.	Chemical Assistant (Madras)
Dr. V. Balakrishnan, Ph.D.	Research Assistant (Vizhingam)
Shri K. Srinivasan Rao, M.Sc.	Research Assistant (Waltair)
Miss M. Dharmamba, M.Sc.	Research Assistant (Waltair)
Shri K. Venkatanarayana Rao, M.Sc.	Research Assistant (Calicut)
Shri M. Narayananbutty, B.Sc. (Hons)	Survey Assistant (Calicut)
Shri K.H. Dhulkhed, M.Sc.	Research Assistant (Ratnagiri)
Miss F.S. Shaik Mahmud, M.Sc.	Research Assistant
Shri C.V. Gangadara Reddi, M.Sc.	Research Assistant (Vizhingam)
Shri B.T. Antony Raja, M.A., M.Sc.	Research Assistant (Tuticorin)
Shri T.A. Mammen, M.Sc.	Research Assistant (Quilon)
Shri S. Gopalan Nayar, B.Sc.	Survey Assistant (Trivandrum)
Shri A.S. Kaikini, B.Sc.	Survey Assistant (Mangalore)
Shri P.T. Meenakshisundram, B.Sc.	Survey Assistant (Nagapattinam)
Shri C.P. Shanmughavalu, B.Sc.	Survey Assistant (Tuticorin)
Shri S.A. Mukarram, B.Sc.	Survey Assistant (Nellore)
Shri K. Venkata Subba Rao, M.Sc.	Survey Assstant
Shri M.G. Dayanandan, B.Sc.	Survey Assistant (Alleppy)
Shri A.K. Chatterjee, B.Sc.	Survey Assistant (Calcutta)
Shri V. Sadasiwan, M.A., M.Sc.	Assistant Research Officer (Calcutta)
Shri K.H. Mohamed, M.Sc.	do.
Shri P. Mazumdar, B.Sc.	Research Assistant (Calcutta)
Shri S.S. Dan, B.Sc.	Survey Assistant (Gopalpur)
Shri N.D. Chhaya, M.Sc.	Survey Assistant (Vebraval)
Shri M.G. Bhide, B.Sc.	Survey Assistant (Surat)
Shri K.Y. Telang, M.Sc.	Survey Assistant (Satpati)
Shri T.K. Srinivasan, B.Sc. (Hons.)	Survey Assistant (Pamban)
Shri S.S. Gogate, B.Sc.	Chemical Assistant (Bombay)

FOREST RESEARCH INSTITUTE AND COLLEGES

Dehra Dun (U. P.)

Name	*Designation*
Shri R.D. Datta	President, F.R.I. and Colleges
Shri I.J. Malhan, B.A.	Registrar
Shri K.K. Shome, M.A. (Com)	Accounts Officer
Dr R.N. Gideon, M.B., B.S.	Medical Officer
Composite Wood Branch	
Dr. D. Narayanamurti, M.Sc., A.I.I.Sc., A.I.C., F. Inst. P., A.M. Chem. E., Dr. Ing., F.N.I.	Chief Research Officer
Shri Nirmal Chand Jain, M.Sc.	Junior Research Officer
Shri B.N. Prasad, M.Sc.	do.
Shri Joseph George, M.Sc.	do.
Dr. P.R. Rao, D.Sc.	do.
Wood Seasoning Branch	
Shri M.A. Rehman, M.Sc., A.R.I.	Chief Research Officer
Shri Jai Kishen, M.Sc.	Junior Research Officer
Minor Forest Products Branch	
Shri R.L. Badhwar, M.Sc.	Chief Research Officer
Shri S. Ramaswami, M.A. Diploma I.F.S. College, Dehra Dun	Forest Officer
Shri A.C. Dey, I.Sc.	Junior Research Officer
Statistical Branch	
Dr. K.R. Nair, M.A., M.Sc., Ph.D. (Lond.), F.S.S., F.A.S.A.	Chief Research Officer
Shri R.P. Bhargava, M.A., M.Sc., B.L.	Junior Research Officer (Assistant Statistician)
Entomology Branch	
Dr. R.N. Mathur, M.Sc. Ph.D.	Chief Research Officer
Dr. P N. Chatterjee, D. Phil.	Junior Research Officer
Shri P.K. Sen Sarma, M.Sc	Junior Research Officer
Silviculture Branch	
Shri S.K. Seth, M.Sc., A.I.F.C.	Silviculturist
Shri G.S. Mathauda, M.A., A.I.F.C.	Assistant Silviculturist
Shri S.N. Dabral, B.Sc.	Statistical Assistant Silviculturist
Shri Jai Singh Pal Yadav, M.Sc. (Agri)	Junior Research Officer (Soil Chemist)
Shri Vinod Kumar Sharma	Officer-in-charge, Photo Section
Timber Engineering Branch	
Shri N.J. Masani, B.E. (Civil), A.M.I.E. (India) Chartered Engineer	Senior Research Officer-in-Charge
Botany Branch	
Shri M.B. Raizada, M.Sc.	Senior Research Officer-in-Charge
Shri G.R. Hingorani, M.Sc.	Junior Research Officer
Shri H.S. Rao, D.Sc., F.B.S.	do.
Shri K.C. Sahni, M.Sc.	do.
Cellulose and Paper Branch	
Dr. R.V. Bhat, M.Sc. (Tech.), Ph.D. (Bombay), Ph.D. (Mrefer), A.R.I.C., A.T.I.	Senior Research Officer-in-Charge
Dr. S.R.D. Guha, M.A., M.Sc., Ph.D., A.R.I.C.	Junior Research Officer
Shri M.G. Karnik, M.Sc.	do.
Shri Man Mohan Singh, M.Sc.	do.
Shri K.C. Virmani, M.Sc. (Tech.)	do.
Wood Preservation Branch	
Dr. A. Purushotham, M.Sc., D.Sc.	Senior Research Officer-in-Charge
Shri J.N. Pande, B.Sc.	Junior Research Officer
Shri N.R. Dass, M.Sc.	Research Officer

FOREST RESEARCH INSTITUTE AND COLLEGES—(*Contd.*)

Name	*Designation*
Timber Mechanics Branch	
Shri A.C. Sekher, M.Sc.	Senior Research Officer-in-Charge
Shri B.S. Rawat, B.E., A.M.I.E. (India)	Junior Research Officer
Wood Anatomy Branch	
Shri S.S. Ghosh, M.Sc.	Senior Research Officer
Shri K. Ramesh Rao, M.A., B.Sc. (Hons.)	Junior Research Officer
Shri S.K. Purkayastha, M.Sc.	do.
Logging Branch	
Shri Niranjan Singh	Senior Research Officer-in-charge
Service Branch	
Shri P.S. Shivaram, B.E. (M and E)	Senior Research Officer-in-charge (Mechanical Engineer)
Chemistry of Forest Products Branch	
Dr. P.S. Rao, D.Sc., F.A.Sc.	Junior Research Officer
Mycology Branch	
Dr. B.K. Bakshi, Ph.D.	Junior Research Officer-in-charge
Publicity Branch	
Shri O.P. Bhargava, B.Sc. Dip. For (Oxon), A.I.F.C., D.D.R. (Hons.)	Publicity and Liaison Officer
Shri K.A. Isaac, B.Sc., M.Lib. Sc.	Librarian
Forest Education	
Shri P.D. Stracey, I.F.S.	Director of Forest Education

INDIAN FOREST COLLEGE, DEHRA DUN

Shri Y.M.L. Sharma, M.Sc., I.F.C.	Dean, Indian Forest College
Shri N.J. Masani, B.E. (Civil) A.M.I.E. (India) Chartered Engineer	Lecturer-in-Engineering and Surveying
Shri O.P. Bhargava, B.Sc., Dip. For. (Oxon),A.I.F.C.,D.D.R. (Hons.)	Lecturer
Shri S.A. Shah, B.Sc. (Hons.), A.I.F.C., B.F.S.	do.
Shri A.L. Rao, A.I.F.C.	do.
Shri P.G. Sathe, A.I.F.C.	do.
Shri A.B. Rudra, M.Sc., A.I.F.C., W.B.F.S.	do.
Shri O.E. Peters, B.Sc., D.P.E.	P.T. and Games Instructor

NORTHERN FOREST RANGER'S COLLEGE, DEHRA DUN

Dr. S. Krishnaswamy, B.Sc. (Mysore), M.Sc. (Cal), A.I.F.C., Doctor of Forestry (Yale, U.S.A.)	Principal
Shri Jaswant Singh, D.D.R.H., P.F.S. (II)	Instructor
Shri J.C. Varmah, M.Sc., M.A. (Oxen), F.B.S. (Forestry)	do.
Shri Ram Prakash, M.A.D.D.R.	Assistant Instructor
Shri L.S. Khanna, D.D.R.	do.
Shri M.V. Achar, M.Sc., B.E.	Assistant Instructor in Engineering and Surveying

SOUTHERN FOREST RANGER'S COLLEGE, COIMBATORE

Dr. D.A. Rama Rao, B.Sc., A.I.I.Sc., Ph.D.	Principal
Shri K.K. Nair, B.Sc., A.I.F.C.	Instructor
Shri S.V. Venkataramanan, B.A., M.R.H.	do.
Shri V. Govind Menon	do.
Shri T.K. Rajagopalan, B.Sc., D.D.R.	Assistant Instructor
Shri S.S. Harisinghani, M.R.H.	do.
Shri J.P. Thomas, M.Sc., B.E.	Assistant Lecturer in Engineering and Surveying
Shri V.M. Narasimhan, B.Sc., D.D.R.	Instructor-in-Charge, Regional Forester's School

FOREST RESEARCH LABORATORY, BANGALORE

Dr. M.N. Ramaswamy, M.Sc., D.Sc. (Munich) F.A.Sc.	Senior Research Officer-in charge
Shri B.K. Chelvarajan	Junior Research Officer

COTTON TECHNOLOGICAL LABORATORY

Matunga (Bombay)

Name	*Designation*
Dr. R.L.N. Iyengar, D.Sc.	Director
Shri Harirao Navkal, M.Sc.	Senior Research Officer
Shri K.S. Bhujang, M.Sc. (Tech.)	do.
Shri V.V. Gupta, B.Sc. Tech, (Manch), B.Sc. (Bom.)	Spinning Master
Shri V. Venkataraman, M.A.	Statistician
Dr. V. Sundaram, M.Sc., Ph. D., A.R.I.C.	Junior Research Officer
Shri Jai Prakash, M.Sc.	do.
Shri S.M. Betrabet, M.Sc.	do.
Shri N. Balasubramanian, B.Sc. B.Sc. (Tech.)	Research Scholar
Shri T.V. Krishnan, M.Sc.	do.
Shri V. G. Munshi, M.Sc.	do.
Shri V.N. Modak, B.Sc.	Supdt. Testing House
Shri P.S. Sambamurthy	Senior Assistant(Testing)
Shri R.G. Panvalkar, B.Sc.	do.
Shri P.V. Nachane, B.Sc.	do.
Shri B.G. Mehta	do.
Shri S. Samson, B.Sc., LLB.	do.
Shri S.B. Mogre, M.Sc.	do.
Shri P.D. Vakil	do.
Shri C.A.S. Iyer, B.Sc.	do.
Shri S. Ramanathan	do.
Shri N.C. Chiplunkar, B.Sc.	Junior Assistant (Testing)
Shri J.M. Shah, B.Sc.	do.
Shri K.P. Ramakrishna Pillai, B. Sc., A.T.I.	do.
Shri R. Narayan Rao, B.Sc.	do.
Shri H.M. Almeida, B.Sc.	do.
Shri R. Braganza, B.Sc.	do.
Shri K.N. Sheshan, B.Sc.	do.
Shri P.G. Oka, B.Sc.	do.
Shrimati S.B. Pai, B.Sc. (Hons.)	do.
Shri G.G. Phadnis, B.Sc.	do.
Shri M.S. Sitaramiah, B.Sc.	do.
Shri M.N. Upponi, B.Sc.	do.
Shri M.S. Sawant, B.Sc.	do.
Shri M.G. Rege, B.Sc.	do.
Shri R. Dwarkanath, B.Sc.	do.
Shri S. Srinivasan, B.Sc.	do.
Kumari Indira G. Bhatt, M.Sc.	do.
Shri M.G. Nambiar, B.Sc.	do.
Shri K.S. Subbanarasimha, B.Sc.	do.
Mrs. K.L. Datar, B.Sc.	do.
Shri S.V. Shetye, B.Sc.	do.
Shri K. Venkateswaran, B.A.	Senior Assistant (Statistics)
Shri P.D. Ghangurde, M.Sc.	-do.
Miss S.P. Gupte, B.A.	Junior Assistant (Statistics)
Shri D.G. Shete, L.M.E.	Gin Supervisor
Shri H.V. Tamhankar L.M.E., L.E.E.	Electrician
Shri A.G.N. Iyengar,	1st Spg. Assistant
Shri P.B. Joshi, L.T.M.	2nd Spg. Assistant
Shri T.S. Jaganath, B.Text.	-do.
Shri Y.N. Tendulkar	Draftsman
Shri Mohd. Mastan Shaikh	Mechanic

COTTON TECHNOLOGICAL LABORATORY—(*Contd.*)

Name	*Designation*
Shri N.G. Paul, B.Sc.	Senior Assistant (Technological)
Shri M. Radhakrishnan, B.Sc.	do.
Shri K.S. Marar, B.A., LL.B.	do.
Shri S.K. Iyer	Junior Assistant (Technological)
Shri K.G. Deo	Senior Assistant (Technological)
Shri Y.N. Yardi	Junior Assistant (Technological)
Shri K.V.N. Nayar	Senior Assistant (Technological)
Shri W.R. Sharma	Junior Assistant (Technological)
Shri L.R. Jambunathan, B.Sc.	Senior Assistant (Technological)
Shri H.R. Nayak	Senior Assistant (Technological)
Shri M.U. Parmar, M.Sc.	Senior Assistant (Technological)
Shri R.C. Sanklia	Junior Assistant (Technological)

INSTITUTE OF PLANT INDUSTRY

Indore (Madhya Pradesh)

Name	*Designation*
Shri J.L. Merh, M.Sc.	Director
Shri P.D. Gadkari, M.Sc., M.Ag. (Texas)	Economic Botanist
Shri Bholanath, M.Sc.	Economic Botanist
Shri K.M. Simlote, M.Sc. (Ag.) Hons., B. Ag., LL.B.	II Economic Botanist
Shri D. Ganesan, M.Sc.	Assistant Botanist
Shri V.B. Sahasrabudhe, M.Sc.	Assistant Statistician
Shri Sardarsingh, B.Sc.	Agronomist
Shri T.M. Koyal, B.Sc. (Agri)	Farm Superintendent
Shri H.P. Bhatia, M.Sc.	Botanical Assistant
Shri S.N. Kulkarni, M.Sc.	Pathological Assistant
Shri Amerjit Rampal, B.Sc. (Agr.)	Botanical Assistant
Shri Puransingh Sangwan, M.Sc. (Egypt)	Botanist
Shri K.N. Agrawal, M.Sc.	Statistical Assistant
Shri L.N. Desai, B.Sc.	Assistant Farm Superintendent
Shri B.B. Tipnis, B. Ag.	Farm Assistant
Shri O.P. Sharma, M.Sc.	Mycological Assistant
Shri B.G. Apte, B.Sc.	Chemical Assistant

Technological Research Scheme

Shri K.V.N. Nayar, Inter Science	Senior Technological Assistant
Shri W.R. Sharma, B.Sc.	Junior Technological Assistant

Physiological Section

Professor R.H. Dastur, M.Sc.	Co-ordinating Officer

Scheme for Physiological Research on Linseed

Shri J.G. Bhatt, M.Sc.	Assistant Physiologist
Shri S.A. Kumar, B.Sc.	Research Assistant

Scheme for Determining Potash Requirement of Cotton

Shri Y.S. Kapse, M.Sc.	Assistant Statistician
Shri D.B. Sashasrabudhe, M.Sc.	Research Assistant
Shri S.A. Anand, M.Sc.	do.

Co-ordinated Scheme on Pre-soaking seeds in Nutrient Salts

Shri L.T. Mone, B.Sc.	do.

JUTE TECHNOLOGICAL RESEARCH LABORATORIES

Calcutta (West Bengal)

Name	*Designation*
Dr. P.B. Sarkar, D.Sc., F.N.I.	Director
Dr. (Mrs.) A. Mathew, M.Sc., Ph.D.	Technical Assistant to the Director
Physics Department	
Dr. K.R. Sen, D.Sc.	Senior Research Physicist
Dr. A.C. Chakrabarti, M.Sc., D. Phil.	Senior Research Assistant
Shri R.K. Basu, M.Sc.	Junior Research Assistant
Shri S.K. Bose, B.Sc.	Senior Physical Assistant
Shri H. Ghosh, B. Sc.	Junior Physical Assistant
X-Ray Department	
Dr. R.K. Sen, D.Sc.	Assistant Physicist
Dr. S.K. Chowdhury, M.Sc., D. Phil.	Junior Research Assistant (Physicist)
Shri S.K. Kar, M.Sc.	do.
Chemistry Department	
Dr. H. Chatterjee, M.Sc. , D. Phil., F.R.I.C.	Senior Research Chemist
Dr. P.C. Das Gupta, M.Sc. D. Phil.	Assistant Chemist
Dr. D.K. Roy Chaudhury, M.Sc., D. Phil.	Junior Research Assistant (Chemist)
Shri A.K. Mazumdar, B.Sc. (Hons), A.R.I.C.	Senior Chemical Assistant
Shri N.K. Dutta, B.Sc.	Junior Chemical Assistant
Chemical Technology Department	
Dr. P.K. Saha, M.Sc. Ph. D. (Manch.)	Senior Chemical Technologist
Shri A.K. Guha, M.Sc.	Senior Research Assistant (Chemist)
Shri S.K. Banerjee, M.Sc.	Junior Research Assistant
Microbiology Department	
Shri R.K. Bose, M.Sc.	Senior Research Assistant (Micro)
Shri A.R. Guha Roy, M.Sc.	Junior Research Assistant (Micro)
Testing Department	
Shri S.B. Bandyopadhyay, M.Sc.	Superintendent, Testing Department
Shri S.R. Guha, B.Sc.	Senior Tester
Shri U. Chatterjee, B.Sc.	do.
Shri S.K. Mukhopadhyay, B.Sc.	do.
Shri S.K. Ghosh, M.Sc.	do.
Shri R.N. Roy, B.Sc.	Statistical Clerk
Shri S.R. Das, B.Sc.	Junior Tester
Shri B.K. Bose, B.Sc.	Junior Tester
Shri S.S. Bhattacharjee, B.Sc.	do.
Shri N.K. Sil, B.Sc.	do.
Shri B.B. Bhowmick, B.Sc.	do.
Shri S. Palit, B.Sc.	do.
Shri P.K. Das, B.Sc.	do.
Spinning and Weaving Department	
Shri K.K. Chatterjee, B.Sc., A.B.T.I.; A.T.I. (Manch.)	Manager, Experimental Spinning and Weaving Mills.
Shri P.K. Deb, B.Sc.	Manager's Assistant
Shri S.P. Bhosh, B.Sc.	Head Mechanic
Shri M.C. Mazumdar, B.Sc.	Weaving Assistant
Shri R.N. Bose	Electrician
Resin Impregnation	
Shri G.C. Bandyopadhyay, M.Sc.	Junior Research Assistant (Chemist)
Paper Pulp Technology Scheme	
Shri S.C. Jain, M.Sc.	Senior Research Assistant (Chemist)

JUTE AGRICULTURAL RESEARCH INSTITUTE

Barrackpore (West Bengal)

Name	*Designation*
Dr. B.C. Kundu, M.A., Ph.D. (Leeds), F.L.S., F.N.I.	Director
Shri K.L. Ghosh, B.Sc., B.Ag.	Technical Assistant to the Director
Botany Section	
Shri B. Dasgupta, M.Sc.	Botanist
Shri B. Roy, M.Sc., (Cal), M.Sc. (Lond).	Assistant Botanist
Shri Samir Kumar Bose, B.Sc., Ag.	Botanical Assistant
Shri S.C. Rakshit, M.Sc.	Herbarium Assistant
Physiology Section	
Dr. B.K. Kar, M.Sc., Ph.D. (Lepzig)	Physiologist
Shri B.K. De refer Sarkar, B.Sc.	Physiological Assistant
Shri J.R. Saha, B.Sc.	Junior Physiological Assistant
Agronomy Section	
Shri B.K. Das, B.Sc., (Ag.)	Assistant Agronomist
Shri S. Pal Chowdhury, B.Sc., B.Ag.	Senior Agronomical Assistant
Shri B.D. Dua, B.Sc. (Ag.)	Agronomical Assistant
Shri Samarendra Nath Mitra, B.Sc. (Ag.)	do.
Agricultural Chemistry Section	
Dr. M.K. Mukherjee, M.Sc., Ph.D., F.N.A. Sc., V.I.C.	Chemist
Shri Ajit Kumar Banerjee, M.Sc.	Assistant Microbiologist
Shri S. Chakraborty, M.Sc.	Senior Chemical Assistant
Shri A.K. Kundu, M.Sc.	Soil Microbiological Assistant
Shri G. Halder, B.Sc.	Biochemical Assistant
Shri Swasti Kumar Basu, M.Sc.	Chemical Assistant
Shri S. Ghosh, B.Sc.	Junior Chemical Assistant
Shri A.B. Roy, B.Sc.	do.
Mycology and Pathology Section	
Shri T. Ghosh, M.Sc.	Assistant Mycologist
Shri N. Mukherjee, M.Sc.	Senior Mycological Assistant
Shri M. Basak, B.Sc.	Mycological Assistant
Shri H.P. Bhattacharjee, B.Sc.	Junior Mycological Assistant
Entomology Section	
Dr. N. Dutt, M.Sc., D. Phil.	Assistant Entomologist
Shri D. Dutta, M.Sc.	Senior Entomological Assistant
Shri Basudev Bhattacharjee, M.Sc.	Entomology Assistant
Shri S.P. Bhattacharjee, B.Sc.	Junior Entomological Assistant
Substitute Fibre Section	
Dr. S.S. Bhattacharjee, M.Sc., Ph.D., (Koln)	Assistant Botanist
Shri Paritosh Sanyal, M.Sc., Assoc. I.A.R.I.	Botanical Assistant
Shri A.N. Dutta, B.Ag.	Agronomical Assistant
Statistics Section	
Shri S.N. Sen, M.Sc.	Statistician
Development Section	
Shri K.L. Gurnani, B. Ag., M.S. (Texas) Post-graduate (I.A.R.I.)	Development Agronomist
Shri S.K. Mazumdar, B.Sc. (Ag.)	Agronomical Assistant
Staff Under Jute Research-*cum*-Developmental Substation, Uttar Pradesh	
Shri M.N. Sanidilya, B.Sc. (Ag.)	Agronomical Assistant
Staff Under Jute Seed Multiplication Farm, Panagarh	
Shri P.K. Das, B.Sc., B.Ag.	Farm Superintendent

CENTRAL COCONUT RESEARCH STATIONS

CENTRAL COCONUT RESEARCH STATION, KAYANGULAM

Name	*Designation*
Dr. K.P.V. Menon, B.Sc., Ph. D. (Lond.), D.I.C.	Director
Dr. K.K. Nirula, M.Sc. (Hons.) Punjab, Assoc. I.A.R.I., Ph. D. (Punjab)	Entomologist
Shri E.J. Verghese, B.A. (Madras), M.Sc. (Madras)	Soil Chemist
Shri T.A. Davis, B.A., Post graduate training at A.R.I. Coimbatore	Plant Physiologist
Dr. Chandy Kurian, B.Sc. (Madras), M.Sc. (Agra), Ph. D. (Agra), F.R.E.S.	Research Assistant (Selection Grade)
Shri H. Sankara-Subramoney, B.Sc. (Travancore) , M.Sc. (Travancore)	do.
Shri U.K. Nair, B.A. (Madras), B. Ag. (Bombay)	do.
Dr. (Mrs.) K. Radha, B.Sc. (Madras), Ph. D. (Madras)	Research Assistant (Ist Grade)
Shri A.P. Anandan, B.A. (Madras)	do.
Shri J. Antony, B.Sc.	do.
Shri M.P. Sankara Narayanan, B.Sc.	do.
Shri K.N. Sahasranaman, B.Sc. (Ag.)	Farm Assistant
Shri N.G. Pillai, B.Sc.	Research Assistant (IInd Grade)
Kumari S.G. Lilly, B.Sc.	do.
Shri K.J. Thomman, B.Sc.	do.

CENTRAL COCONUT RESEARCH STATION, KASARGOD

Dr. K.M. Pandalai M.Sc., Ph.D.	Joint Director
Shri S.R. Gangoly, M.Sc.	Cyto-Anatomist
Shri M.M. Krishna Marar B.Sc. (Ag.)	Agronomist
Shri P.K. Thomas B.Sc. (Ag.) Assoc. I.A.R.I.	Research Assistant (Ist Grade)
Shri M. Chathukutty Nambliar B.Sc. (Ag.)	do.
Shri Rama Verma, B.Sc. (Ag.)	do.
Shri K. Satyabalan, B.A.B.Sc. (Ag.)	do.
Shri E. V. Neliatt, B.Sc. (Ag.)	Farm Assistant
Shri P.L. Ramanandapai, B.Sc.	Research Assistant (IInd Grade)
Shri S. Vaitheeswaran, M.Sc.	do.
Shri M.K. Muliyar, B.Sc.	do.
Shri R. Vasadwan Pillai, B.Sc.	do.

CENTRAL ARECANUT RESEARCH STATION, VITTAL

Name	*Designation*
Dr. G.I. Patel, B.Sc. (Agri) Hons., M.S. (Horticulture)	Arecanut Specialist, Central Arecanut Research Station, Vittal
Shri K. Shama Bhat, B.Sc. (Ag.)	Research Assistant
Shri K.V. Ahamed Bavappa, B.Sc. (Ag.)	Agronomy Assistant
Shri K.N. Murthy, B.Sc. (Ag.)	Botany Assistant

CENTRAL TOBACCO RESEARCH INSTITUTE

Rajahmundry

Name	*Designation*
Dr. N.R. Bhat, Ph. D. (Cantab)	Director
Agronomy	
Shri H.T. Khemchandani B.Sc. (Ag.) Hons., M.S. (N. Carolina)	Agronomist
Shri R. Anantharaman, B.Sc. (Ag.)	Agronomical Assistant
Plant Physiology	
Dr. N.L. Pal, M.Sc., D.Sc., F.N.A.Sc., F.B.S.,	Plant Physiologist
Shri N.C. Gopalachari, M.Sc. (Ag.)	Physiological Assistant
Shri M. Bangarayya, M.Sc. (Ag.)	do.
Plant Breeding	
Shri B. Radhakrishanamurty	Plant Breeding Assistant
Cytology	
Dr. K.V. Krishnamurty, B.Sc. (Hons.) Ph. D.	Assistant Cytogeneticist
Plant Pathology	
Shri D.I. Mathrani, M.Sc. (Ag.) M-S. (N. Carolina)	Plant Pathologist
Entomology	
Dr. (Miss) Annamma Philip, M.Sc., Ph. D.	Entomologist
Shri B.G. Joshi, M.Sc.,	Entomological Assistant
Shri D.P. Parkhe, M.Sc.	do.
Agricultural Chemistry	
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Shri K.V. Venkataraman, B.Sc.	Pedological Assistant
Shri T. Venkatapathi, M.Sc.	Chemical Assistant
Shri T. Gangadharasastry, B.Sc.	Junior Scientific Assistant

CIGARETTE TOBACCO RESEARCH SUBSTATION, GUNTUR

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Shri A. Bhima Sastry, B.Sc. (Ag.)	Botanical Assistant

CIGAR AND CHEROOT TOBACCO RESEARCH STATION, VEDASANDUR

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Shri A.S. Krishnan, B.Sc. (Ag.)	Agri. Assistant
Botany	
Dr. D.M. Gopinath, M.Sc., Ph. D.	Botanist
Shri N.J. Hrishi, M.Sc.	Botanical Assistant
Chemistry	
Shri A.S. Sastry, M.Sc.	Chemist
Shri C.K. Ramakrishna Kurup, M.Sc.	Chemical Assistant

HOOKAH AND CHEWING TOBACCO RESEARCH STATION, PUSA

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WRAPPER AND HOOKAH TOBACCO RESEARCH STATION, DINHATA

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Shri Maharaj Singh, M.Sc. (Ag.)	Agronomical Assistant

TOBACCO RESEARCH STATION, HUNSUR

Shri N.A. Elias, M.Sc. (Ag.)	Plant Pathologist

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Division of Entomology	
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Shri S.N. Gupta, M.Sc.	Biologist
Dr. A. Bhattacharya, M.Sc., D.I.C., Ph.D. (Lond.)	Research Assistant
Shri B.P. Mehra, M.Sc.	do.
Shri C.P. Malhotra, M.Sc.	do.
Shri N.S. Chauhan, M.Sc. (Ag.)	do.
Shri P.S.B.R. James, M.Sc.	do.
Shri B.K. Purakayastha, B.Sc.	Arboricultural Assistant
Shri J.N. Singh	Junior Research Assistant
Shri K.C. Chatterji	do.
Shri M.K. Choudhury	do.
Shri N. Majumdar B.Sc.	do.
Shri P. Sen, B.Sc.	do.
Shri B.P. Misra, B.Sc.	do.
Shri J. Das Gupta, B.Sc.	do.
Shri B.N. Sah, B.Sc.	do.
Division of Chemistry	
Shri Y. Sankaranarayanan, M.Sc.	Shellac Utilisation Officer
Shri T.P. Bhowmik, M.Sc.	Scientific Officer
Shri P.R. Bhattacharya, M.Sc.	do.
Shri S.C. Sen Gupta, M.Sc.	Research Assistant
Shri P.K. Ghosh, B.Sc.	do.
Shri B.B. Khanna, M.Sc.	do.
Shri V.S. Rao, B.Sc., B.Sc. (Tech.)	do.
Shri P.C. Ghosh, B.Sc. (Hons.)	Analytical Chemist
Shri A.K. Ghosh, B.Sc.	Junior Research Assistant
Shri K.M. Tripathi, B.Sc.	do.
Shri B.K. Ganguli, B.Sc.	Analyst
Shri P.K. Sanyal, B.Sc.	do.
Shri K. Chatterji, B.Sc.,	Junior Research Assistant
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Shri M. Vijaysaradhy, M.Sc., Ph. D. (Lond). D.I.C.	Sugarcane Physiologist
Shri K.V. Srinivasa, B.Sc. (Ag.), Assoc. I.A.R.I.	Mycologist
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Shri R. Narasimhan, B.Sc. (Ag.), M. Sc.	Assistant Sugarcane Expert

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Shri N. Mukerji, B.Sc., A.I.R.A.I.	do.
Shri Suba Singh	Farm Superintendent
Shri Rajendra Singh, M.Sc. (Agri.)	Assistant Farm Superintendent

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Shri A.P. Gupta, M.Sc.	Senior Soil Assistant
Shri S.S. Iyer, M.Sc.	Senior Microbiological Assistant

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Shri A. Subramanyam, B.Sc., B.E. (Mech. Eng.)	Assistant Agricultural Engineer
Shri K.N. Lahiri, Dip. M. and E.E.	Research Assistant

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Shri S.L. Phansalkar, B.Sc., M.S. (La, U.S.A.), A.R.T.C. (Glas)., A.E.I.C. (Lond.)	Professor of Sugar Technology
Shri S.L. Saxena, B.Sc. (Eng.) A.I.I.S.E.	Assistant Professor of Sugar Engineering
Shri S. Mukherji, M.Sc., Ph.D. (Cantab), A.R.I.C., A.I.I.Sc.	do. Chemistry (Organic)
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Shri N.C. Verma, B.Sc., Dip. Tech.	Chief Technical Officer
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Shri R.C. Sharma, B.Sc. (Eng.)	Technical Officer (Instrument)
Shri S.N. Gupta, M.A.	Statistician
Shri B.D. Kapoor, M.Sc.	Junior Technical Officer
Shri H.C. Bhattacharya, B.Sc., A.H.B.T.I.	do.
Sardar Jagjit Singh, B.Sc. (Eng.)	Chief Engineer, Fuel Economy Scheme
Shri B.S. Negi, B.Sc., A.H.B.T.I.	Technical Assistant
Shri J.K.P. Agarwal, B.Sc., A.I.I.S.T., F.I.I.S.T.	do.
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Shri N.C. Jain, B.Sc., A.I.I.S.T.	do.
Shri K.H. Rao, M.A., B.Sc., A.I.I.S.T.	Research Assistant
Shri J.C. Bhargava, B.Sc., A.I.I.S.T.	do.
Shri A.K. Chatterjee, M.Sc.	do.
Shri Vishnu, M.Sc.	do.
Shri S.K.D. Agarwal, M.Sc.	do.
Shri J.P. Bansal, B.Sc., A.I.I.S.T.	do.
Shri K.A. Prabhu, M.Sc.	do.
Shri Sarvarinath, B.Sc., A.I.I.S.T.	do.
Shri C.D. Rajpal, Diploma in Engineering	do.